(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 September 2004 (30.09.2004)

PCT

(10) International Publication Number
WO 2004/083591 A2

(51) International Patent Classification[7]: E21B

(21) International Application Number: PCT/US2004/008030

(22) International Filing Date: 17 March 2004 (17.03.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/455,124 17 March 2003 (17.03.2003) US

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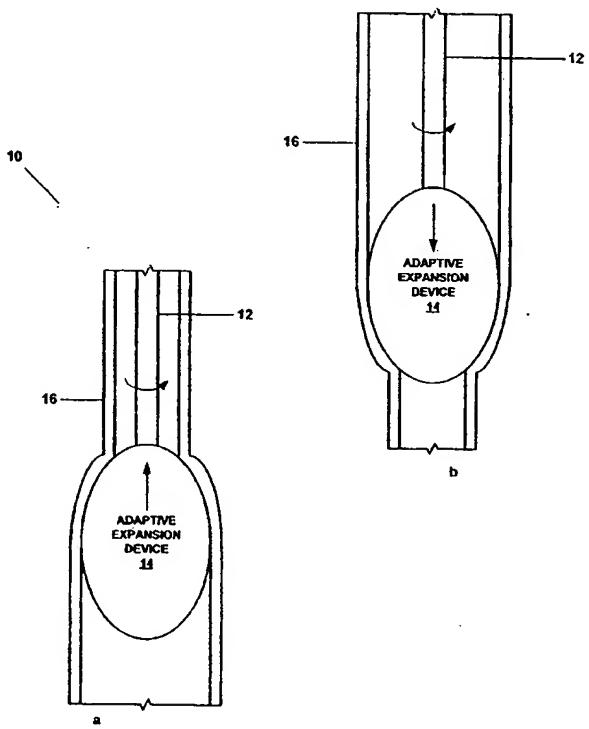
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

[Continued on next page]

(54) Title: APPARATUS AND METHOD FOR RADIALLY EXPANDING A WELLBORE CASING USING AN ADAPTIVE EXPANSION SYSTEM

(57) Abstract: An apparatus and method for radially expanding a wellbore using an adaptive expansion system.



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Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

APPARATUS AND METHOD FOR RADIALLY EXPANDING A WELLBORE CASING USING AN ADAPTIVE EXPANSION SYSTEM

Cross Reference To Related Applications

[001] The present application claims the benefit of the filing date of U.S. provisional patent application serial no. 60/455,124, attorney docket no. 25791.241, filed on March 17, 2003, the disclosure of which is incorporated herein by reference.

[002] The present application is related to the following: (1) U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, which claims priority from provisional application 60/121,702, filed on 2/25/99, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (4) U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (5) U.S. patent application serial no. 10/169,434, attorney docket no. 25791.10.04, filed on 7/1/02, which claims priority from provisional application 60/183,546, filed on 2/18/00, (6) U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (7) U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (8) U.S. patent number 6,575,240, which was filed as patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, which claims priority from provisional application 60/121,907, filed on 2/26/99, (9) U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (10) U.S. patent application serial no. 09/981,916, attorney docket no. 25791.18, filed on 10/18/01 as a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (11) U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (12) U.S. patent application serial no. 10/030,593, attorney docket no. 25791.25.08, filed on 1/8/02, which claims priority from provisional application 60/146,203, filed on 7/29/99, (13) U.S. provisional patent application serial no. 60/143,039, attorney docket no. 25791.26, filed

on 7/9/99, (14) U.S. patent application serial no. 10/111,982, attorney docket no. 25791.27.08, filed on 4/30/02, which claims priority from provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (15) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (16) U.S. provisional patent application serial no. 60/438,828, attorney docket no. 25791.31, filed on 1/9/03, (17) U.S. patent number 6,564,875, which was filed as application serial no. 09/679,907, attorney docket no. 25791.34.02, on 10/5/00, which claims priority from provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (18) U.S. patent application serial no. 10/089,419, filed on 3/27/02, attorney docket no. 25791.36.03, which claims priority from provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (19) U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (20) U.S. patent application serial no. 10/303,992, filed on 11/22/02, attorney docket no. 25791.38.07, which claims priority from provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (21) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (22) U.S. provisional patent application serial no. 60/455,051, attorney docket no. 25791.40, filed on 3/14/03, (23) PCT application US02/2477, filed on 6/26/02, attorney docket no. 25791.44.02, which claims priority from U.S. provisional patent application serial no. 60/303,711, attorney docket no. 25791.44, filed on 7/6/01, (24) U.S. patent application serial no. 10/311,412, filed on 12/12/02, attorney docket no. 25791.45.07, which claims priority from provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (25) U.S. patent application serial no. 10/, filed on 12/18/02, attorney docket no. 25791.46.07, which claims priority from provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (26) U.S. patent application serial no. 10/322,947, filed on 1/22/03, attorney docket no. 25791.47.03, which claims priority from provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (27) U.S. patent application serial no. 10/406,648, filed on 3/31/03, attorney docket no. 25791.48.06, which claims priority from provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (28) PCT application US02/04353, filed on 2/14/02, attorney docket no. 25791.50.02, which claims priority from U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001, (29) U.S. patent application serial no. 10/465,835, filed on 6/13/03, attorney docket no. 25791.51.06, which claims priority from provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001, (30) U.S. patent application serial no. 10/465,831, filed on 6/13/03, attorney docket no. 25791.52.06,

which claims priority from U.S. provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001, (31) U.S. provisional patent application serial no. 60/452,303, filed on 3/5/03, attorney docket no. 25791.53, (32) U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (33) U.S. patent number 6,561,227, which was filed as patent application serial number 09/852,026 , filed on 5/9/01, attorney docket no. 25791.56, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (34) U.S. patent application serial number 09/852,027, filed on 5/9/01, attorney docket no. 25791.57, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (35) PCT Application US02/25608, attorney docket no. 25791.58.02, filed on 8/13/02, which claims priority from provisional application 60/318,021, filed on 9/7/01, attorney docket no. 25791.58, (36) PCT Application US02/24399, attorney docket no. 25791.59.02, filed on 8/1/02, which claims priority from U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001, (37) PCT Application US02/29856, attorney docket no. 25791.60.02, filed on 9/19/02, which claims priority from U.S. provisional patent application serial no. 60/326,886, attorney docket no. 25791.60, filed on 10/3/2001, (38) PCT Application US02/20256, attorney docket no. 25791.61.02, filed on 6/26/02, which claims priority from U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001, (39) U.S. patent application serial no. 09/962,469, filed on 9/25/01, attorney docket no. 25791.62, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (40) U.S. patent application serial no. 09/962,470, filed on 9/25/01, attorney docket no. 25791.63, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (41) U.S. patent application serial no. 09/962,471, filed on 9/25/01, attorney docket no. 25791.64, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (42) U.S. patent application serial no. 09/962,467, filed on 9/25/01, attorney docket no. 25791.65, which is a divisional of U.S. patent application serial

no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (43) U.S. patent application serial no. 09/962,468, filed on 9/25/01, attorney docket no. 25791.66, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (44) PCT application US 02/25727, filed on 8/14/02, attorney docket no. 25791.67.03, which claims priority from U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001, and U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001, (45) PCT application US 02/39425, filed on 12/10/02, attorney docket no. 25791.68.02, which claims priority from U.S. provisional patent application serial no. 60/343,674 , attorney docket no. 25791.68, filed on 12/27/2001, (46) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (47) U.S. utility patent application serial no. 10/516,467, attorney docket no. 25791.70, filed on 12/10/01, which is a continuation application of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (48) PCT application US 03/00609, filed on 1/9/03, attorney docket no. 25791.71.02, which claims priority from U.S. provisional patent application serial no. 60/357,372 , attorney docket no. 25791.71, filed on 2/15/02, (49) U.S. patent application serial no. 10/074,703, attorney docket no. 25791.74, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (50) U.S. patent application serial no. 10/074,244, attorney docket no. 25791.75, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (51) U.S. patent application serial no. 10/076,660, attorney docket no. 25791.76, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (52) U.S. patent application serial no. 10/076,661, attorney docket no. 25791.77, filed on 2/15/02, which is a divisional of U.S. patent number

6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (53) U.S. patent application serial no. 10/076,659, attorney docket no. 25791.78, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (54) U.S. patent application serial no. 10/078,928, attorney docket no. 25791.79, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (55) U.S. patent application serial no. 10/078,922, attorney docket no. 25791.80, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (56) U.S. patent application serial no. 10/078,921, attorney docket no. 25791.81, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (57) U.S. patent application serial no. 10/261,928, attorney docket no. 25791.82, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (58) U.S. patent application serial no. 10/079,276 , attorney docket no. 25791.83, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (59) U.S. patent application serial no. 10/262,009, attorney docket no. 25791.84, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (60) U.S. patent application serial no. 10/092,481, attorney docket no. 25791.85, filed on 3/7/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (61) U.S. patent application serial no. 10/261,926, attorney docket no. 25791.86, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional

application 60/137,998, filed on 6/7/99, (62) PCT application US 02/36157, filed on 11/12/02, attorney docket no. 25791.87.02, which claims priority from U.S. provisional patent application serial no. 60/338,996, attorney docket no. 25791.87, filed on 11/12/01, (63) PCT application US 02/36267, filed on 11/12/02, attorney docket no. 25791.88.02, which claims priority from U.S. provisional patent application serial no. 60/339,013, attorney docket no. 25791.88, filed on 11/12/01, (64) PCT application US 03/11765, filed on 4/16/03, attorney docket no. 25791.89.02, which claims priority from U.S. provisional patent application serial no. 60/383,917, attorney docket no. 25791.89, filed on 5/29/02, (65) PCT application US 03/15020, filed on 5/12/03, attorney docket no. 25791.90.02, which claims priority from U.S. provisional patent application serial no. 60/391,703, attorney docket no. 25791.90, filed on 6/26/02, (66) PCT application US 02/39418, filed on 12/10/02, attorney docket no. 25791.92.02, which claims priority from U.S. provisional patent application serial no. 60/346,309, attorney docket no. 25791.92, filed on 1/7/02, (67) PCT application US 03/06544, filed on 3/4/03, attorney docket no. 25791.93.02, which claims priority from U.S. provisional patent application serial no. 60/372,048, attorney docket no. 25791.93, filed on 4/12/02, (68) U.S. patent application serial no. 10/331,718, attorney docket no. 25791.94, filed on 12/30/02, which is a divisional U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (69) PCT application US 03/04837, filed on 2/29/03, attorney docket no. 25791.95.02, which claims priority from U.S. provisional patent application serial no. 60/363,829, attorney docket no. 25791.95, filed on 3/13/02, (70) U.S. patent application serial no. 10/261,927, attorney docket no. 25791.97, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (71) U.S. patent application serial no. 10/262,008, attorney docket no. 25791.98, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (72) U.S. patent application serial no. 10/261,925, attorney docket no. 25791.99, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (73) U.S. patent application serial no. 10/199,524, attorney docket no. 25791.100, filed on 7/19/02, which is a continuation of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (74) PCT application US

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Background of the Invention

[003] This invention relates generally to oil and gas exploration, and in particular to forming and repairing wellbore casings to facilitate oil and gas exploration.

[004] Conventionally, when a wellbore is created, a number of casings are installed in the borehole to prevent collapse of the borehole wall and to prevent undesired outflow of drilling fluid into the formation or inflow of fluid from the formation into the borehole. The borehole is drilled in intervals whereby a casing which is to be installed in a lower borehole interval is lowered through a previously installed casing of an upper borehole interval. As a consequence of this procedure the casing of the lower interval is of smaller diameter than the casing of the upper interval. Thus, the casings are in a nested arrangement with casing diameters decreasing in downward direction. Cement annuli are provided between the outer surfaces of the casings and the borehole wall to seal the casings from the borehole wall. As a consequence of this nested arrangement a relatively large borehole diameter is required at the upper part of the wellbore. Such a large borehole diameter involves increased costs due

to heavy casing handling equipment, large drill bits and increased volumes of drilling fluid and drill cuttings. Moreover, increased drilling rig time is involved due to required cement pumping, cement hardening, required equipment changes due to large variations in hole diameters drilled in the course of the well, and the large volume of cuttings drilled and removed.

[005] The present invention is directed to overcoming one or more of the limitations of the existing procedures for forming and/or repairing wellbore casings.

Summary of the Invention

[006] According to one aspect of the present invention, an apparatus for radially expanding and plastically deforming a tubular member is provided that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member that includes a support structure coupled to the support member; one or more expansion device segments for engaging the tubular member to thereby radially expand and plastically deform the tubular member; one or more adjustable spring elements coupled between the support structure and one or more of the expansion device segments; one or more adjustable damping elements coupled between the support structure and one or more of the expansion device segments; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the tubular member by the adaptive expansion device; a controller operably coupled to the adjustable spring elements, the adjustable damping elements, and the sensors; and a user interface operably coupled to the controller for receiving user inputs; wherein the controller is programmed to controllably adjust a spring rate of one or more of the adjustable spring elements, and a damping rate of one or more of the damping elements as a function of the operating conditions sensed by the sensors and the user inputs.

[007] According to another aspect of the present invention, a method of adaptively radially expanding a tubular member within a wellbore is provided that includes inserting an adaptive expansion device into the tubular member; radially expanding and plastically deforming the tubular member using the adaptive expansion device; sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and as a function of the sensed operating conditions, controllably adjusting a spring rate and a damping rate of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

[008] According to another aspect of the present invention, a system for adaptively radially expanding a tubular member within a wellbore is provided that includes means for inserting an adaptive expansion device into the tubular member; means for radially expanding and plastically deforming the tubular member using the adaptive expansion device; means for sensing one or more operating conditions during the radial expansion and plastic

deformation of the tubular member; and means for, as a function of the sensed operating conditions, controllably adjusting a spring rate and a damping rate of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

[009] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming a tubular member is provided that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member that includes a support structure coupled to the support member; one or more expansion device segments for engaging the tubular member to thereby radially expand and plastically deform the tubular member; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the tubular member by the adaptive expansion device; and a controller operably coupled to the expansion device segments and the sensors; wherein the controller is programmed to controllably adjust a frequency characteristic of one or more of the expansion device segments as a function of the operating conditions sensed by the sensors.

[0010] According to another aspect of the present invention, a method of adaptively radially expanding a tubular member within a wellbore is provided that includes inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the tubular member; radially expanding and plastically deforming the tubular member using the adaptive expansion device; sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and as a function of the sensed operating conditions, controllably adjusting a frequency response characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member.

[0011] According to another aspect of the present invention, a system for adaptively radially expanding a tubular member within a wellbore is provided that includes means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the tubular member; means for radially expanding and plastically deforming the tubular member using the adaptive expansion device; means for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and means for, as a function of the sensed operating conditions, controllably adjusting a frequency response characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member.

[0012] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming overlapping ends of first and second tubular members is provided that includes a support member; and an adaptive expansion device coupled to the

support member for radially expanding and plastically deforming the overlapping ends of the tubular members that includes a support structure coupled to the support member; one or more expansion device segments for engaging the overlapping ends of the tubular members to thereby radially expand and plastically deform the overlapping ends of the tubular member; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the overlapping ends of the tubular member by the adaptive expansion device; and a controller operably coupled to the expansion device segments and the sensors; wherein the controller is programmed to controllably adjust one or more operational characteristics of one or more of the expansion device segments as a function of a sensing of the overlapping ends of the tubular members by one or more of the sensors.

[0013] According to another aspect of the present invention, a method of adaptively radially expanding overlapping ends of tubular members within a wellbore is provided that includes inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the overlapping ends of the tubular members; radially expanding and plastically deforming the overlapping ends of the tubular members using the adaptive expansion device; sensing the overlapping ends of the tubular members during the radial expansion and plastic deformation of the overlapping ends of the tubular members; and as a function of the sensing of the overlapping ends of the tubular members, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the overlapping ends of the tubular members.

[0014] According to another aspect of the present invention, a system for adaptively radially expanding overlapping ends of tubular members within a wellbore is provided that includes means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the overlapping ends of the tubular members; means for radially expanding and plastically deforming the overlapping ends of the tubular members using the adaptive expansion device; means for sensing the overlapping ends of the tubular members during the radial expansion and plastic deformation of the overlapping ends of the tubular members; and means for, as a function of the sensing of the overlapping ends of the tubular members, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the overlapping ends of the tubular members.

[0015] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming first and second tubular members coupled to one another by a threaded connection is provided that includes a support member; and an

adaptive expansion device coupled to the support member for radially expanding and plastically deforming the threaded connection that includes a support structure coupled to the support member; one or more expansion device segments for engaging the threaded connection to thereby radially expand and plastically deform the threaded connection; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the threaded connection by the adaptive expansion device; and a controller operably coupled to the expansion device segments and the sensors; wherein the controller is programmed to controllably adjust one or more operational characteristics of one or more of the expansion device segments as a function of a sensing of the threaded connection by one or more of the sensors.

[0016] According to another aspect of the present invention, a method of adaptively radially expanding tubular members coupled to one another by a threaded connection within a wellbore is provided that includes inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular members proximate the threaded connection; radially expanding and plastically deforming the threaded connection using the adaptive expansion device; sensing the threaded connection during the radial expansion and plastic deformation of the threaded connection; and as a function of the sensing of the threaded connection, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the threaded connection.

[0017] According to another aspect of the present invention, a system for adaptively radially expanding tubular members coupled to one another by a threaded connection within a wellbore is provided that includes means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular members proximate the threaded connection; means for radially expanding and plastically deforming the threaded connection using the adaptive expansion device; means for sensing the threaded connection during the radial expansion and plastic deformation of the threaded connection; and means for, as a function of the sensing of the threaded connection, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the threaded connection.

[0018] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming a tubular member within a wellbore that traverses a subterranean formation is provided that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation that includes a support structure coupled to the support member; one or more expansion device

segments for engaging the threaded connection to thereby radially expand and plastically deform the tubular member and elastically deform the subterranean formation; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation; and a controller operably coupled to the expansion device segments and the sensors; wherein the controller is programmed to controllably adjust one or more operational characteristics of one or more of the expansion device segments as a function of a sensing of the subterranean formation by one or more of the sensors.

[0019] According to another aspect of the present invention, a method of adaptively radially expanding a tubular member within a wellbore that traverses a subterranean formation is provided that includes inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation within the wellbore; radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation using the adaptive expansion device; sensing the subterranean formation during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation; and as a function of the sensing of the subterranean formation, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation.

[0020] According to another aspect of the present invention, a system for adaptively radially expanding a tubular member within a wellbore that traverses a subterranean formation is provided that includes means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation within the wellbore; means for radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation using the adaptive expansion device; means for sensing the subterranean formation during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation; and means for, as a function of the sensing of the subterranean formation, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation.

[0021] According to another aspect of the present invention, an apparatus for radially expanding and plastically deforming a tubular member is provided that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member that includes a support structure

coupled to the support member; and one or more expansion device segments coupled to the support structure for engaging the tubular member to thereby radially expand and plastically deform the tubular member; one or more sensors for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and a controller operably coupled to the expansion device segments and the sensors; and wherein the controller is programmed to controllably adjust one or more of the operational characteristics of one or more the expansion device segments as a function of the operating conditions sensed by the sensors.

[0022] According to another aspect of the present invention, a method of adaptively radially expanding a tubular member within a wellbore is provided that includes inserting an adaptive expansion device into the tubular member; radially expanding and plastically deforming the tubular member using the adaptive expansion device; sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and as a function of the sensed operating conditions, controllably adjusting one or more of the operating characteristics of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

[0023] According to another aspect of the present invention, a system for adaptively radially expanding a tubular member within a wellbore is provided that includes means for inserting an adaptive expansion device into the tubular member; means for radially expanding and plastically deforming the tubular member using the adaptive expansion device; means for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and means for, as a function of the sensed operating conditions, controllably adjusting one or more of the operating characteristics of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

Brief Description of the Drawings

[0024] Figs. 1a and 1b are fragmentary cross sectional illustrations of an exemplary embodiment of an adaptive system for radially expanding a tubular member.

[0025] Fig. 2 is a schematic illustration of an exemplary embodiment of the adaptive expansion device of the system of Figs. 1a and 1b.

[0026] Figs. 3a-3c are fragmentary cross sectional illustrations of exemplary embodiments of the operation of the adaptive system of Figs. 1a and 1b.

Detailed Description of the Illustrative Embodiments

[0027] Referring to Figs. 1a, 1b, and 2, an adaptive system 10 for radially expanding a tubular member includes a support member 12 and an adaptive expansion device 14. In several exemplary embodiments, the system 10 may be used to radially expand and plastically deform a tubular member 16 by displacing the expansion device 14 in the longitudinal direction and/or by rotating the expansion device relative to the tubular member.

[0028] In an exemplary embodiment, the adaptive expansion device 14 includes one or more expansion device segments 18 for engaging, and thereby radially expanding and plastically deforming the tubular member 16, that are coupled to an expansion device support structure 20 by one or more conventional adjustable spring elements 22 and one or more conventional adjustable damping elements 24. In several exemplary embodiments, the adjustable spring elements 22 and/or the adjustable damping elements 24 are be provided as disclosed in one or more of the following: 1) U.S. Patent No. 6,431,284, 2) U.S. Patent No. 6,390,956, 3) U.S. Patent No. 6,296,533, 4) U.S. Patent No. 6,237,889, 5) U.S. Patent No. 6,220,089, 6) U.S. Patent No. 6,159,289, 7) U.S. Patent No. 6,105,988, 8) U.S. Patent No. 6,065,741, 9) U.S. Patent No. 6,062,324, 10) U.S. Patent No. 6,035,954, 11) U.S. Patent No. 5,947,458, 12) U.S. Patent No. 5,875,567, 13) U.S. Patent No. 5,713,088, 14) U.S. Patent No. 5,603,574, 15) U.S. Patent No. 5,364,565, 16) 5,531,522, 17) U.S. Patent No. 5,464,197, 18) U.S. Patent No. 5,421,655, 19) U.S. Patent No. 5,201,392, 20) U.S. Patent No. 5,169,129, 21) U.S. Patent No. 5,005,820, 22) U.S. Patent No. 4,984,632, 23) U.S. Patent No. 4,862,995, 24) U.S. Patent No. 4,789,343, 25) U.S. Patent No. 4,657,280, 26) U.S. Patent No. 4,624,477, 27) U.S. Patent No. 4,575,058, 28) U.S. Patent No. 4,566,717, 29) U.S. Patent No. 4,509,403, 30) U.S. Patent No. 4,277,045, and/or 31) U.S. Patent No. 4,071,104, the disclosures of which are incorporated herein by reference.

[0029] In several exemplary embodiments, the expansion device segments 18 include, for example, segments of a conventional expansion cone and/or conventional roller expansion elements and/or conventional hydro-forming elements. The expansion device support structure 20 is also coupled to the support member 12. The adjustable spring and damping elements, 22 and 24, are also operably coupled to a controller 26, and one or more sensors 28 are also operably coupled to the controller 26 for reasons to be described. A user interface 28 may also be provided that is operably coupled to the controller 26. In several exemplary embodiments, the controller 26 includes analog, digital, electronic, and/or hydraulic control elements that may or may not be positioned within the adaptive expansion device 14. In several alternative embodiments, the user interface 28 may include a conventional keyboard input device and/or a conventional display device and/or a conventional communication channel for linking the user interface to the controller 26.

[0030] In an exemplary embodiment, during the operation of the system 10, the controller 26 is programmed to adjust the spring rate of the adjustable spring elements 22 and/or the damping rate of the adjustable damping elements 24 as a function of one or more operating conditions that are sensed by the sensors 28. In several exemplary embodiments, the sensed operating conditions may include the reaction forces of the tubular member 16, the operating pressure of fluidic materials within the system 10 and/or the tubular member, the

rotational speed of the system, the longitudinal speed of the system, and/or one or more user defined inputs to the controller 26 provided via the user interface 28.

[0031] In an exemplary embodiment, at least one of the sensors 28 includes a conventional strain gauge that senses the reaction force of the tubular member 16 during the radial expansion and plastic deformation of the tubular member by the system 10. In an exemplary embodiment, increases in the sensed reaction force causes the controller 26 to increase or decrease the spring rate of one or more of the adjustable spring elements 22 thereby increasing or decreasing the stiffness of the corresponding expansion device segments 18. In this manner, the forces applied to the tubular member 16 may be increased or decreased for example, to provide increased or decreased radial expansion forces as a function of the sensed reaction forces.

[0032] In an exemplary embodiment, at least one of the sensors 28 includes a conventional pressure sensor that senses the operating pressures of fluidic materials within the system 10 and/or the tubular member 16 during the radial expansion and plastic deformation of the tubular member by the system 10. In an exemplary embodiment, the value of the sensed operating pressure causes the controller 26 to increase or decrease the spring rate of one or more of the adjustable spring elements 22 thereby increasing or decreasing the stiffness of the corresponding expansion device segments 18. In this manner, the forces applied to the tubular member 16 may be increased or decreased for example, to provide increased or decreased radial expansion forces as a function of the sensed operating pressures.

[0033] In an exemplary embodiment, the controller 26 is programmed to adaptively adjust the spring rates of one or more of the adjustable spring elements 22 and/or the damping rate of one or more of the adjustable damping elements 24 to control the frequency response of one or more of the corresponding expansion device segments to provide, for example, an underdamped, a critically damped, or an overdamped frequency response. In this manner, the system 10 can provide an adaptive expansion system having user defined operational characteristics that may vary as a function of one or more sensed operating conditions.

[0034] Referring to Fig. 3a, in an exemplary embodiment, the system 10 is used to radially expand and plastically deform the overlapping ends of tubular members, 16 and 30. In an exemplary embodiment, during the radial expansion and plastic deformation of the overlapping ends of the tubular members, 16 and 30, the reaction forces of the overlapping ends of the tubular members, 16 and 30, are sensed by one or more of the sensors 28, and, if the sensed reaction forces increase, the spring rates of one or more of the adjustable spring elements 22 of the adaptive expansion device 14 are increased to thereby increase the radial expansion forces applied to the overlapping ends of the tubular members. In this manner, the system 10 can controllably adjust the radial expansion forces applied to overlapping tubulars thereby enhancing the radial expansion process. In an alternative

embodiment, the location of the overlapped ends of the tubular members, 16 and 30, may be input into the controller 26 using the user interface 28 to control the initiation of the adjustment of the spring rates of the adjustable spring elements 22 in combination with, or in the alternative to, the sensing of the reaction forces described above.

[0035] Referring to Fig. 3b, in an exemplary embodiment, the system 10 is used to radially expand and plastically deform a tubular member 16 that includes first and second tubular members, 16a and 16b, coupled to one another by a threaded connection 32. In an exemplary embodiment, during the radial expansion and plastic deformation of the threaded connection 32, the reaction forces of the threaded connection are sensed by one or more of the sensors 26, and, the spring rates and/or the damping rate of one or more of the adjustable spring elements 22 and/or adjustable damping elements 24 of the adaptive expansion device 14 are adjusted to thereby minimize damage to the integrity of the threaded connection during the radial expansion process. For example, the spring rates one or more of the adjustable spring elements 22 may be reduced to minimize damage to the integrity of the threaded connection 32 during the radial expansion process and/or the damping rates of one or more of the adjustable damping elements 24 may be increased to minimize shock loading of the threaded connection during the radial expansion process. In an alternative embodiment, the location of the threaded connection 32 may be input into the controller 26 using the user interface 28 to control the initiation of the adjustment of the spring rates and/or damping rates of the adjustable spring elements 22 and/or damping elements 24 in combination with, or in the alternative to, the sensing of the reaction forces described above.

[0036] Referring to Fig. 3c, in an exemplary embodiment, the system 10 is used to radially expand and elastically deform a subterranean formation 34 during the radial expansion and plastic deformation of the tubular member 16. In an exemplary embodiment, during the radial expansion and plastic deformation of the tubular member 16 against the subterranean formation 34, the reaction forces of the formation 34 are sensed by one or more of the sensors 28, and the spring rates of one or more of the adjustable spring elements 22 of the adaptive expansion device 14 are increased to thereby increase the radial expansion forces applied to the formation. In this manner, the system 10 can controllably adjust the radial expansion forces applied to the formation 34 surrounding the tubular member 16 during the radial expansion and plastic deformation of the tubular member. In an alternative embodiment, the location of the formation 34 may be input into the controller 26 using the user interface 28 to control the initiation of the adjustment of the spring rates of the adjustable spring elements 22 in combination with, or in the alternative to, the sensing of the reaction forces described above.

[0037] In several alternative embodiments, the exemplary embodiments of the present disclosure are implemented using the methods and/or apparatus disclosed one or more of the following: (1) U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, which claims priority from provisional application 60/121,702, filed on 2/25/99, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (4) U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (5) U.S. patent application serial no. 10/169,434, attorney docket no. 25791.10.04, filed on 7/1/02, which claims priority from provisional application 60/183,546, filed on 2/18/00, (6) U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (7) U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (8) U.S. patent number 6,575,240, which was filed as patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, which claims priority from provisional application 60/121,907, filed on 2/26/99, (9) U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (10) U.S. patent application serial no. 09/981,916, attorney docket no. 25791.18, filed on 10/18/01 as a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (11) U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (12) U.S. patent application serial no. 10/030,593, attorney docket no. 25791.25.08, filed on 1/8/02, which claims priority from provisional application 60/146,203, filed on 7/29/99, (13) U.S. provisional patent application serial no. 60/143,039, attorney docket no. 25791.26, filed on 7/9/99, (14) U.S. patent application serial no. 10/111,982, attorney docket no. 25791.27.08, filed on 4/30/02, which claims priority from provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (15) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (16) U.S. provisional patent application

serial no. 60/438,828, attorney docket no. 25791.31, filed on 1/9/03, (17) U.S. patent number 6,564,875, which was filed as application serial no. 09/679,907, attorney docket no. 25791.34.02, on 10/5/00, which claims priority from provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (18) U.S. patent application serial no. 10/089,419, filed on 3/27/02, attorney docket no. 25791.36.03, which claims priority from provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (19) U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (20) U.S. patent application serial no. 10/303,992, filed on 11/22/02, attorney docket no. 25791.38.07, which claims priority from provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (21) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (22) U.S. provisional patent application serial no. 60/455,051, attorney docket no. 25791.40, filed on 3/14/03, (23) PCT application US02/2477, filed on 6/26/02, attorney docket no. 25791.44.02, which claims priority from U.S. provisional patent application serial no. 60/303,711, attorney docket no. 25791.44, filed on 7/6/01, (24) U.S. patent application serial no. 10/311,412, filed on 12/12/02, attorney docket no. 25791.45.07, which claims priority from provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (25) U.S. patent application serial no. 10/, filed on 12/18/02, attorney docket no. 25791.46.07, which claims priority from provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (26) U.S. patent application serial no. 10/322,947, filed on 1/22/03, attorney docket no. 25791.47.03, which claims priority from provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (27) U.S. patent application serial no. 10/406,648, filed on 3/31/03, attorney docket no. 25791.48.06, which claims priority from provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (28) PCT application US02/04353, filed on 2/14/02, attorney docket no. 25791.50.02, which claims priority from U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001, (29) U.S. patent application serial no. 10/465,835, filed on 6/13/03, attorney docket no. 25791.51.06, which claims priority from provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001, (30) U.S. patent application serial no. 10/465,831, filed on 6/13/03, attorney docket no. 25791.52.06, which claims priority from U.S. provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001, (31) U.S. provisional patent application serial no. 60/452,303, filed on 3/5/03, attorney docket no. 25791.53, (32) U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a

divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (33) U.S. patent number 6,561,227, which was filed as patent application serial number 09/852,026 , filed on 5/9/01, attorney docket no. 25791.56, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (34) U.S. patent application serial number 09/852,027, filed on 5/9/01, attorney docket no. 25791.57, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (35) PCT Application US02/25608, attorney docket no. 25791.58.02, filed on 8/13/02, which claims priority from provisional application 60/318,021, filed on 9/7/01, attorney docket no. 25791.58, (36) PCT Application US02/24399, attorney docket no. 25791.59.02, filed on 8/1/02, which claims priority from U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001, (37) PCT Application US02/29856, attorney docket no. 25791.60.02, filed on 9/19/02, which claims priority from U.S. provisional patent application serial no. 60/326,886, attorney docket no. 25791.60, filed on 10/3/2001, (38) PCT Application US02/20256, attorney docket no. 25791.61.02, filed on 6/26/02, which claims priority from U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001, (39) U.S. patent application serial no. 09/962,469, filed on 9/25/01, attorney docket no. 25791.62, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (40) U.S. patent application serial no. 09/962,470, filed on 9/25/01, attorney docket no. 25791.63, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (41) U.S. patent application serial no. 09/962,471, filed on 9/25/01, attorney docket no. 25791.64, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (42) U.S. patent application serial no. 09/962,467, filed on 9/25/01, attorney docket no. 25791.65, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (43) U.S. patent application serial no. 09/962,468, filed on 9/25/01, attorney docket no. 25791.66, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application

60/124,042, filed on 3/11/99, (44) PCT application US 02/25727, filed on 8/14/02, attorney docket no. 25791.67.03, which claims priority from U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001, and U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001, (45) PCT application US 02/39425, filed on 12/10/02, attorney docket no. 25791.68.02, which claims priority from U.S. provisional patent application serial no. 60/343,674 , attorney docket no. 25791.68, filed on 12/27/2001, (46) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (47) U.S. utility patent application serial no. 10/516,467, attorney docket no. 25791.70, filed on 12/10/01, which is a continuation application of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (48) PCT application US 03/00609, filed on 1/9/03, attorney docket no. 25791.71.02, which claims priority from U.S. provisional patent application serial no. 60/357,372 , attorney docket no. 25791.71, filed on 2/15/02, (49) U.S. patent application serial no. 10/074,703, attorney docket no. 25791.74, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (50) U.S. patent application serial no. 10/074,244, attorney docket no. 25791.75, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (51) U.S. patent application serial no. 10/076,660, attorney docket no. 25791.76, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (52) U.S. patent application serial no. 10/076,661, attorney docket no. 25791.77, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (53) U.S. patent application serial no. 10/076,659, attorney docket no. 25791.78, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no.

25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (54) U.S. patent application serial no. 10/078,928, attorney docket no. 25791.79, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (55) U.S. patent application serial no. 10/078,922, attorney docket no. 25791.80, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (56) U.S. patent application serial no. 10/078,921, attorney docket no. 25791.81, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (57) U.S. patent application serial no. 10/261,928, attorney docket no. 25791.82, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (58) U.S. patent application serial no. 10/079,276 , attorney docket no. 25791.83, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (59) U.S. patent application serial no. 10/262,009, attorney docket no. 25791.84, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (60) U.S. patent application serial no. 10/092,481, attorney docket no. 25791.85, filed on 3/7/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (61) U.S. patent application serial no. 10/261,926, attorney docket no. 25791.86, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (62) PCT application US 02/36157, filed on 11/12/02, attorney docket no. 25791.87.02, which claims priority from U.S. provisional patent application serial no. 60/338,996, attorney docket no. 25791.87, filed on 11/12/01, (63) PCT application US 02/36267, filed on 11/12/02, attorney docket no. 25791.88.02, which claims priority from U.S. provisional patent application serial no. 60/339,013, attorney docket no.

25791.88, filed on 11/12/01, (64) PCT application US 03/11765, filed on 4/16/03, attorney docket no. 25791.89.02, which claims priority from U.S. provisional patent application serial no. 60/383,917, attorney docket no. 25791.89, filed on 5/29/02, (65) PCT application US 03/15020, filed on 5/12/03, attorney docket no. 25791.90.02, which claims priority from U.S. provisional patent application serial no. 60/391,703, attorney docket no. 25791.90, filed on 6/26/02, (66) PCT application US 02/39418, filed on 12/10/02, attorney docket no. 25791.92.02, which claims priority from U.S. provisional patent application serial no. 60/346,309, attorney docket no. 25791.92, filed on 1/7/02, (67) PCT application US 03/06544, filed on 3/4/03, attorney docket no. 25791.93.02, which claims priority from U.S. provisional patent application serial no. 60/372,048, attorney docket no. 25791.93, filed on 4/12/02, (68) U.S. patent application serial no. 10/331,718, attorney docket no. 25791.94, filed on 12/30/02, which is a divisional U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (69) PCT application US 03/04837, filed on 2/29/03, attorney docket no. 25791.95.02, which claims priority from U.S. provisional patent application serial no. 60/363,829, attorney docket no. 25791.95, filed on 3/13/02, (70) U.S. patent application serial no. 10/261,927, attorney docket no. 25791.97, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (71) U.S. patent application serial no. 10/262,008, attorney docket no. 25791.98, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (72) U.S. patent application serial no. 10/261,925, attorney docket no. 25791.99, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (73) U.S. patent application serial no. 10/199,524, attorney docket no. 25791.100, filed on 7/19/02, which is a continuation of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (74) PCT application US 03/10144, filed on 3/28/03, attorney docket no. 25791.101.02, which claims priority from U.S. provisional patent application serial no. 60/372,632, attorney docket no. 25791.101, filed on 4/15/02, (75) U.S. provisional patent application serial no. 60/412,542, attorney docket no. 25791.102, filed on 9/20/02, (76) PCT application US 03/14153, filed on 5/6/03, attorney docket no. 25791.104.02, which claims priority from U.S. provisional patent

application serial no. 60/380,147, attorney docket no. 25791.104, filed on 5/6/02, (77) PCT application US 03/19993, filed on 6/24/03, attorney docket no. 25791.106.02, which claims priority from U.S. provisional patent application serial no. 60/397,284, attorney docket no. 25791.106, filed on 7/19/02, (78) PCT application US 03/13787, filed on 5/5/03, attorney docket no. 25791.107.02, which claims priority from U.S. provisional patent application serial no. 60/387,486 , attorney docket no. 25791.107, filed on 6/10/02, (79) PCT application US 03/18530, filed on 6/11/03, attorney docket no. 25791.108.02, which claims priority from U.S. provisional patent application serial no. 60/387,961, attorney docket no. 25791.108, filed on 6/12/02, (80) PCT application US 03/20694, filed on 7/1/03, attorney docket no. 25791.110.02, which claims priority from U.S. provisional patent application serial no. 60/398,061, attorney docket no. 25791.110, filed on 7/24/02, (81) PCT application US 03/20870, filed on 7/2/03, attorney docket no. 25791.111.02, which claims priority from U.S. provisional patent application serial no. 60/399,240, attorney docket no. 25791.111, filed on 7/29/02, (82) U.S. provisional patent application serial no. 60/412,487, attorney docket no. 25791.112, filed on 9/20/02, (83) U.S. provisional patent application serial no. 60/412,488, attorney docket no. 25791.114, filed on 9/20/02, (84) U.S. patent application serial no. 10/280,356, attorney docket no. 25791.115, filed on 10/25/02, which is a continuation of U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (85) U.S. provisional patent application serial no. 60/412,177, attorney docket no. 25791.117, filed on 9/20/02, (86) U.S. provisional patent application serial no. 60/412,653, attorney docket no. 25791.118, filed on 9/20/02, (87) U.S. provisional patent application serial no. 60/405,610, attorney docket no. 25791.119, filed on 8/23/02, (88) U.S. provisional patent application serial no. 60/405,394, attorney docket no. 25791.120, filed on 8/23/02, (89) U.S. provisional patent application serial no. 60/412,544, attorney docket no. 25791.121, filed on 9/20/02, (90) PCT application US 03/24779, filed on 8/8/03, attorney docket no. 25791.125.02, which claims priority from U.S. provisional patent application serial no. 60/407,442, attorney docket no. 25791.125, filed on 8/30/02, (91) U.S. provisional patent application serial no. 60/423,363, attorney docket no. 25791.126, filed on 12/10/02, (92) U.S. provisional patent application serial no. 60/412,196, attorney docket no. 25791.127, filed on 9/20/02, (93) U.S. provisional patent application serial no. 60/412,187, attorney docket no. 25791.128, filed on 9/20/02, (94) U.S. provisional patent application serial no. 60/412,371, attorney docket no. 25791.129, filed on 9/20/02, (95) U.S. patent application serial no. 10/382,325, attorney docket no. 25791.145, filed on 3/5/03, which is a continuation of U.S. patent number 6,557,640, which was filed as patent application serial

no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (96) U.S. patent application serial no. 10/624,842, attorney docket no. 25791.151, filed on 7/22/03, which is a divisional of U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (97) U.S. provisional patent application serial no. 60/431,184, attorney docket no. 25791.157, filed on 12/5/02, (98) U.S. provisional patent application serial no. 60/448,526, attorney docket no. 25791.185, filed on 2/18/03, (99) U.S. provisional patent application serial no. 60/461,539, attorney docket no. 25791.186, filed on 4/9/03, (100) U.S. provisional patent application serial no. 60/462,750, attorney docket no. 25791.193, filed on 4/14/03, (101) U.S. provisional patent application serial no. 60/436,106, attorney docket no. 25791.200, filed on 12/23/02, (102) U.S. provisional patent application serial no. 60/442,942, attorney docket no. 25791.213, filed on 1/27/03, (103) U.S. provisional patent application serial no. 60/442,938, attorney docket no. 25791.225, filed on 1/27/03, (104) U.S. provisional patent application serial no. 60/418,687, attorney docket no. 25791.228, filed on 4/18/03, (105) U.S. provisional patent application serial no. 60/454,896, attorney docket no. 25791.236, filed on 3/14/03, (106) U.S. provisional patent application serial no. 60/450,504, attorney docket no. 25791.238, filed on 2/26/03, (107) U.S. provisional patent application serial no. 60/451,152, attorney docket no. 25791.239, filed on 3/9/03, (108) U.S. provisional patent application serial no. 60/455,124, attorney docket no. 25791.241, filed on 3/17/03, (109) U.S. provisional patent application serial no. 60/453,678, attorney docket no. 25791.253, filed on 3/11/03, (110) U.S. patent application serial no. 10/421,682, attorney docket no. 25791.256, filed on 4/23/03, which is a continuation of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (111) U.S. provisional patent application serial no. 60/457,965, attorney docket no. 25791.260, filed on 3/27/03, (112) U.S. provisional patent application serial no. 60/455,718, attorney docket no. 25791.262, filed on 3/18/03, (113) U.S. patent number 6,550,821, which was filed as patent application serial no. 09/811,734, filed on 3/19/01, (114) U.S. patent application serial no. 10/436,467, attorney docket no. 25791.268, filed on 5/12/03, which is a continuation of U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (115) U.S. provisional patent application serial no. 60/459,776, attorney docket no. 25791.270, filed on 4/2/03, (116) U.S. provisional patent application serial no. 60/461,094, attorney docket no. 25791.272, filed on 4/8/03, (117) U.S. provisional patent application serial no. 60/461,038, attorney docket no. 25791.273, filed on 4/7/03, (118) U.S. provisional patent application serial no. 60/463,586, attorney docket no.

25791.277, filed on 4/17/03, (119) U.S. provisional patent application serial no. 60/472,240, attorney docket no. 25791.286, filed on 5/20/03, (120) U.S. patent application serial no. 10/619,285, attorney docket no. 25791.292, filed on 7/14/03, which is a continuation-in-part of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (121) U.S. utility patent application serial no. 10/418,688, attorney docket no. 25791.257, which was filed on 4/18/03, as a division of U.S. utility patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (122) PCT patent application serial no. PCT/US04/_____, attorney docket no. 25791.238.02, filed on 2/26/2004, (123) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.40.02, filed on 3/15/04_____, (124) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.236.02, filed on 3/15/04, and (125) PCT patent application serial number PCT/US04/_____, attorney docket number 25791.253.02, filed on 3/11/2004, (125) conventional rotary expansion tools such as, for example, as described in U.S. 6,457,532 and/or WO 02/081863 A1, or any one of the commercially available rotary expansion tools available from Weatherford International, Inc., and/or (126) conventional hydro-forming methods and tools, the disclosures of which are incorporated herein by reference.

[0038] More generally, the operational characteristics of the adaptive expansion device 14 may be determined as a function of empirical data regarding the tubular member 16 determined during a radial expansion testing procedure. For example, if a certain spring rate and/or damping rate, or range and/or variation in spring rate and/or damping rate, for one or more of the adjustable spring elements 22 and/or one or more of the adjustable damping elements 24 provide enhanced operational performance of the tubular member 16, before, during or after, a radial expansion and plastic deformation of the tubular member, then the preferred spring rate and/or damping rate, or the range and/or variation in the spring rate and/or damping rate, for one or more of the adjustable spring elements 22 and/or one or more of the adjustable damping elements 24 may be programmed into the controller 26 to thereby provide enhanced radial expansion and plastic deformation of the tubular member using the adaptive expansion device 14.

[0039] An apparatus for radially expanding and plastically deforming a tubular member has been described that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member that includes a support structure coupled to the support member; one or more expansion

device segments for engaging the tubular member to thereby radially expand and plastically deform the tubular member; one or more adjustable spring elements coupled between the support structure and one or more of the expansion device segments; one or more adjustable damping elements coupled between the support structure and one or more of the expansion device segments; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the tubular member by the adaptive expansion device; a controller operably coupled to the adjustable spring elements, the adjustable damping elements, and the sensors; and a user interface operably coupled to the controller for receiving user inputs; wherein the controller is programmed to controllably adjust a spring rate of one or more of the adjustable spring elements, and a damping rate of one or more of the damping elements as a function of the operating conditions sensed by the sensors and the user inputs.

[0040] A method of adaptively radially expanding a tubular member within a wellbore has been described that includes inserting an adaptive expansion device into the tubular member; radially expanding and plastically deforming the tubular member using the adaptive expansion device; sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and as a function of the sensed operating conditions, controllably adjusting a spring rate and a damping rate of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

[0041] A system for adaptively radially expanding a tubular member within a wellbore has been described that includes means for inserting an adaptive expansion device into the tubular member; means for radially expanding and plastically deforming the tubular member using the adaptive expansion device; means for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and means for, as a function of the sensed operating conditions, controllably adjusting a spring rate and a damping rate of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

[0042] An apparatus for radially expanding and plastically deforming a tubular member has been described that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member that includes a support structure coupled to the support member; one or more expansion device segments for engaging the tubular member to thereby radially expand and plastically deform the tubular member; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the tubular member by the adaptive expansion device; and a controller operably coupled to the expansion device segments and the sensors; wherein the controller is programmed to controllably adjust a frequency characteristic of one or more of the expansion device segments as a function of the

operating conditions sensed by the sensors.

[0043] A method of adaptively radially expanding a tubular member within a wellbore has been described that includes inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the tubular member; radially expanding and plastically deforming the tubular member using the adaptive expansion device; sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and as a function of the sensed operating conditions, controllably adjusting a frequency response characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member.

[0044] A system for adaptively radially expanding a tubular member within a wellbore has been described that includes means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the tubular member; means for radially expanding and plastically deforming the tubular member using the adaptive expansion device; means for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and means for, as a function of the sensed operating conditions, controllably adjusting a frequency response characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member.

[0045] An apparatus for radially expanding and plastically deforming overlapping ends of first and second tubular members has been described that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the overlapping ends of the tubular members that includes a support structure coupled to the support member; one or more expansion device segments for engaging the overlapping ends of the tubular members to thereby radially expand and plastically deform the overlapping ends of the tubular member; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the overlapping ends of the tubular member by the adaptive expansion device; and a controller operably coupled to the expansion device segments and the sensors; wherein the controller is programmed to controllably adjust one or more operational characteristics of one or more of the expansion device segments as a function of a sensing of the overlapping ends of the tubular members by one or more of the sensors.

[0046] A method of adaptively radially expanding overlapping ends of tubular members within a wellbore has been described that includes inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the overlapping ends of the tubular

members; radially expanding and plastically deforming the overlapping ends of the tubular members using the adaptive expansion device; sensing the overlapping ends of the tubular members during the radial expansion and plastic deformation of the overlapping ends of the tubular members; and as a function of the sensing of the overlapping ends of the tubular members, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the overlapping ends of the tubular members.

[0047] A system for adaptively radially expanding overlapping ends of tubular members within a wellbore has been described that includes means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the overlapping ends of the tubular members; means for radially expanding and plastically deforming the overlapping ends of the tubular members using the adaptive expansion device; means for sensing the overlapping ends of the tubular members during the radial expansion and plastic deformation of the overlapping ends of the tubular members; and means for, as a function of the sensing of the overlapping ends of the tubular members, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the overlapping ends of the tubular members.

[0048] An apparatus for radially expanding and plastically deforming first and second tubular members coupled to one another by a threaded connection has been described that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the threaded connection that includes a support structure coupled to the support member; one or more expansion device segments for engaging the threaded connection to thereby radially expand and plastically deform the threaded connection; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the threaded connection by the adaptive expansion device; and a controller operably coupled to the expansion device segments and the sensors; wherein the controller is programmed to controllably adjust one or more operational characteristics of one or more of the expansion device segments as a function of a sensing of the threaded connection by one or more of the sensors.

[0049] A method of adaptively radially expanding tubular members coupled to one another by a threaded connection within a wellbore has been described that includes inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular members proximate the threaded connection; radially expanding and plastically deforming the threaded connection using the adaptive expansion device; sensing the threaded connection during the radial expansion and plastic deformation of the threaded connection; and as a function of the

sensing of the threaded connection, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the threaded connection.

[0050] A system for adaptively radially expanding tubular members coupled to one another by a threaded connection within a wellbore has been described that includes means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular members proximate the threaded connection; means for radially expanding and plastically deforming the threaded connection using the adaptive expansion device; means for sensing the threaded connection during the radial expansion and plastic deformation of the threaded connection; and means for, as a function of the sensing of the threaded connection, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the threaded connection.

[0051] An apparatus for radially expanding and plastically deforming a tubular member within a wellbore that traverses a subterranean formation has been described that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation that includes a support structure coupled to the support member; one or more expansion device segments for engaging the threaded connection to thereby radially expand and plastically deform the tubular member and elastically deform the subterranean formation; and one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation; and a controller operably coupled to the expansion device segments and the sensors; wherein the controller is programmed to controllably adjust one or more operational characteristics of one or more of the expansion device segments as a function of a sensing of the subterranean formation by one or more of the sensors.

[0052] A method of adaptively radially expanding a tubular member within a wellbore that traverses a subterranean formation has been described that includes inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation within the wellbore; radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation using the adaptive expansion device; sensing the subterranean formation during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation; and as a function of the sensing of the subterranean formation, controllably adjusting an operational characteristic of one or more of the expansion device segments

during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation.

[0053] A system for adaptively radially expanding a tubular member within a wellbore that traverses a subterranean formation has been described that includes means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation within the wellbore; means for radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation using the adaptive expansion device; means for sensing the subterranean formation during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation; and means for, as a function of the sensing of the subterranean formation, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation.

[0054] An apparatus for radially expanding and plastically deforming a tubular member has been described that includes a support member; and an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member that includes a support structure coupled to the support member; and one or more expansion device segments coupled to the support structure for engaging the tubular member to thereby radially expand and plastically deform the tubular member; one or more sensors for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and a controller operably coupled to the expansion device segments and the sensors; and wherein the controller is programmed to controllably adjust one or more of the operational characteristics of one or more the expansion device segments as a function of the operating conditions sensed by the sensors.

[0055] A method of adaptively radially expanding a tubular member within a wellbore has been described that includes inserting an adaptive expansion device into the tubular member; radially expanding and plastically deforming the tubular member using the adaptive expansion device; sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and as a function of the sensed operating conditions, controllably adjusting one or more of the operating characteristics of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

[0056] A system for adaptively radially expanding a tubular member within a wellbore has been described that includes means for inserting an adaptive expansion device into the tubular member; means for radially expanding and plastically deforming the tubular member using the adaptive expansion device; means for sensing one or more operating conditions

during the radial expansion and plastic deformation of the tubular member; and means for, as a function of the sensed operating conditions, controllably adjusting one or more of the operating characteristics of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

[0057] In several exemplary embodiments, one or more of the expansion device segments includes one or more expansion surfaces; and an actuator coupled to the expansion surfaces. In an exemplary embodiment, the actuator includes one or more degrees of freedom. In an exemplary embodiment, the actuator includes a plurality of degrees of freedom. In an exemplary embodiment, the actuator includes one or more rotary actuators. In an exemplary embodiment, one or more of the expansion device segments include one or more hydro-forming devices.

[0058] In several exemplary embodiments, radially expanding and plastically deforming the tubular member using the adaptive expansion device includes displacing the adaptive expansion device relative to the tubular member in the longitudinal direction. In several exemplary embodiments, radially expanding and plastically deforming the tubular member using the adaptive expansion device includes rotating the adaptive expansion device relative to the tubular member. In an exemplary embodiment, radially expanding and plastically deforming the tubular member using the adaptive expansion device includes applying a pressurized fluid to the interior surface of the tubular member. In several exemplary embodiments, the means for radially expanding and plastically deforming the tubular member using the adaptive expansion device includes means for displacing the adaptive expansion device. In several exemplary embodiments, the means for displacing the adaptive expansion device includes one or more degrees of freedom. In several exemplary embodiments, the means for displacing the adaptive expansion device includes a plurality of degrees of freedom. In several exemplary embodiments, the means for radially expanding and plastically deforming the tubular member using the adaptive expansion device includes means for radially expanding and plastically deforming the tubular member using a hydro-forming device.

[0059] It is understood that variations may be made in the foregoing without departing from the scope of the invention. For example, the teachings of the present illustrative embodiments may be used to provide a wellbore casing, a pipeline, or a structural support. Furthermore, one or more of the tubular members, 16 and 30, may be slotted, perforated, or otherwise include one or more radial passages. In addition, the adaptive expansion device 14 may be displaced in the longitudinal direction and/or rotated relative to the tubular member 16 during the radial expansion and plastic deformation of the tubular member.

[0060] Although illustrative embodiments of the invention have been shown and described, a wide range of modification, changes and substitution is contemplated in the foregoing

disclosure. In some instances, some features of the present invention may be employed without a corresponding use of the other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

Claims

What is claimed is:

1. An apparatus for radially expanding and plastically deforming a tubular member, comprising:

a support member; and

an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member, comprising:

a support structure coupled to the support member;

one or more expansion device segments for engaging the tubular member to thereby radially expand and plastically deform the tubular member;

one or more adjustable spring elements coupled between the support structure and one or more of the expansion device segments;

one or more adjustable damping elements coupled between the support structure and one or more of the expansion device segments; and

one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the tubular member by the adaptive expansion device;

a controller operably coupled to the adjustable spring elements, the adjustable damping elements, and the sensors; and

a user interface operably coupled to the controller for receiving user inputs;

wherein the controller is programmed to controllably adjust a spring rate of one or more of the adjustable spring elements, and a damping rate of one or more of the damping elements as a function of the operating conditions sensed by the sensors and the user inputs.

2. A method of adaptively radially expanding a tubular member within a wellbore, comprising:

inserting an adaptive expansion device into the tubular member;

radially expanding and plastically deforming the tubular member using the adaptive expansion device;

sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and

as a function of the sensed operating conditions, controllably adjusting a spring rate and a damping rate of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

3. A system for adaptively radially expanding a tubular member within a wellbore, comprising:

means for inserting an adaptive expansion device into the tubular member;

means for radially expanding and plastically deforming the tubular member using the adaptive expansion device;

means for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and

means for, as a function of the sensed operating conditions, controllably adjusting a spring rate and a damping rate of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

4. An apparatus for radially expanding and plastically deforming a tubular member, comprising:

a support member; and

an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member, comprising:

a support structure coupled to the support member;

one or more expansion device segments for engaging the tubular member to thereby radially expand and plastically deform the tubular member; and

one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the tubular member by the adaptive expansion device; and

a controller operably coupled to the expansion device segments and the sensors;

wherein the controller is programmed to controllably adjust a frequency characteristic of one or more of the expansion device segments as a function of the operating conditions sensed by the sensors.

5. A method of adaptively radially expanding a tubular member within a wellbore, comprising:

inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the tubular member;

radially expanding and plastically deforming the tubular member using the adaptive expansion device;

sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and

as a function of the sensed operating conditions, controllably adjusting a frequency response characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member.

6. A system for adaptively radially expanding a tubular member within a wellbore, comprising:

means for inserting an adaptive expansion device comprising one or more expansion

device segments for engaging and radially expanding and plastically deforming the tubular member into the tubular member;

means for radially expanding and plastically deforming the tubular member using the adaptive expansion device;

means for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and

means for, as a function of the sensed operating conditions, controllably adjusting a frequency response characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member.

7. An apparatus for radially expanding and plastically deforming overlapping ends of first and second tubular members, comprising:

a support member; and

an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the overlapping ends of the tubular members, comprising:

a support structure coupled to the support member;

one or more expansion device segments for engaging the overlapping ends of the tubular members to thereby radially expand and plastically deform the overlapping ends of the tubular member; and

one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the overlapping ends of the tubular member by the adaptive expansion device; and

a controller operably coupled to the expansion device segments and the sensors;

wherein the controller is programmed to controllably adjust one or more operational characteristics of one or more of the expansion device segments as a function of a sensing of the overlapping ends of the tubular members by one or more of the sensors.

8. A method of adaptively radially expanding overlapping ends of tubular members within a wellbore, comprising:

inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the overlapping ends of the tubular members;

radially expanding and plastically deforming the overlapping ends of the tubular members using the adaptive expansion device;

sensing the overlapping ends of the tubular members during the radial expansion and plastic deformation of the overlapping ends of the tubular members; and

as a function of the sensing of the overlapping ends of the tubular members, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the overlapping ends of the tubular members.

9. A system for adaptively radially expanding overlapping ends of tubular members within a wellbore, comprising:

means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member into the overlapping ends of the tubular members;

means for radially expanding and plastically deforming the overlapping ends of the tubular members using the adaptive expansion device;

means for sensing the overlapping ends of the tubular members during the radial expansion and plastic deformation of the overlapping ends of the tubular members; and

means for, as a function of the sensing of the overlapping ends of the tubular members, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the overlapping ends of the tubular members.

10. An apparatus for radially expanding and plastically deforming first and second tubular members coupled to one another by a threaded connection, comprising:

a support member; and

an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the threaded connection, comprising:

a support structure coupled to the support member;

one or more expansion device segments for engaging the threaded connection to thereby radially expand and plastically deform the threaded connection; and

one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the threaded connection by the adaptive expansion device; and

a controller operably coupled to the expansion device segments and the sensors;

wherein the controller is programmed to controllably adjust one or more operational characteristics of one or more of the expansion device segments as a function of a sensing of the threaded connection by one or more of the sensors.

11. A method of adaptively radially expanding tubular members coupled to one another by a threaded connection within a wellbore, comprising:

inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular members proximate the threaded connection;

radially expanding and plastically deforming the threaded connection using the adaptive expansion device;

sensing the threaded connection during the radial expansion and plastic deformation of the threaded connection; and

as a function of the sensing of the threaded connection, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the threaded connection.

12. A system for adaptively radially expanding tubular members coupled to one another by a threaded connection within a wellbore, comprising:

means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular members proximate the threaded connection;

means for radially expanding and plastically deforming the threaded connection using the adaptive expansion device;

means for sensing the threaded connection during the radial expansion and plastic deformation of the threaded connection; and

means for, as a function of the sensing of the threaded connection, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the threaded connection.

13. An apparatus for radially expanding and plastically deforming a tubular member within a wellbore that traverses a subterranean formation, comprising:

a support member; and

an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation, comprising:

a support structure coupled to the support member;

one or more expansion device segments for engaging the threaded connection to thereby radially expand and plastically deform the tubular member and elastically deform the subterranean formation; and

one or more sensors for sensing operating conditions during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation; and

a controller operably coupled to the expansion device segments and the sensors;

wherein the controller is programmed to controllably adjust one or more operational characteristics of one or more of the expansion device segments as a function of a sensing of the subterranean formation by one or more of the sensors.

14. A method of adaptively radially expanding a tubular member within a wellbore that traverses a subterranean formation, comprising:

inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation within the wellbore;

radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation using the adaptive expansion device;

sensing the subterranean formation during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation; and

as a function of the sensing of the subterranean formation, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation.

15. A system for adaptively radially expanding a tubular member within a wellbore that traverses a subterranean formation, comprising:

means for inserting an adaptive expansion device comprising one or more expansion device segments for engaging and radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation within the wellbore;

means for radially expanding and plastically deforming the tubular member and elastically deforming the subterranean formation using the adaptive expansion device;

means for sensing the subterranean formation during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation; and

means for, as a function of the sensing of the subterranean formation, controllably adjusting an operational characteristic of one or more of the expansion device segments during the radial expansion and plastic deformation of the tubular member and the elastic deformation of the subterranean formation.

16. An apparatus for radially expanding and plastically deforming a tubular

member, comprising:

a support member; and

an adaptive expansion device coupled to the support member for radially expanding and plastically deforming the tubular member, comprising:

a support structure coupled to the support member; and

one or more expansion device segments coupled to the support structure for engaging the tubular member to thereby radially expand and plastically deform the tubular member;

one or more sensors for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and

a controller operably coupled to the expansion device segments and the sensors; and

wherein the controller is programmed to controllably adjust one or more of the operational characteristics of one or more the expansion device segments as a function of the operating conditions sensed by the sensors.

17. A method of adaptively radially expanding a tubular member within a wellbore, comprising:

inserting an adaptive expansion device into the tubular member;

radially expanding and plastically deforming the tubular member using the adaptive expansion device;

sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and

as a function of the sensed operating conditions, controllably adjusting one or more of the operating characteristics of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

18. A system for adaptively radially expanding a tubular member within a wellbore, comprising:

means for inserting an adaptive expansion device into the tubular member;

means for radially expanding and plastically deforming the tubular member using the adaptive expansion device;

means for sensing one or more operating conditions during the radial expansion and plastic deformation of the tubular member; and

means for, as a function of the sensed operating conditions, controllably adjusting one or more of the operating characteristics of the adaptive expansion device during the radial expansion and plastic deformation of the tubular member.

19. The apparatus of claims 1, 4, 7, 10, 13, or 16, wherein one or more of the expansion device segments comprise:

one or more expansion surfaces; and

an actuator coupled to the expansion surfaces.

20. The apparatus of claim 19, wherein the actuator comprises one or more degrees of freedom.

21. The apparatus of claim 20, wherein the actuator comprises a plurality of degrees of freedom.

22. The apparatus of claim 19, wherein the actuator comprises one or more rotary actuators.

23. The apparatus of claims 1, 4, 7, 10, 13, or 16, wherein one or more of the expansion device segments comprise:

one or more hydro-forming devices.

24. The method of claims 2, 5, 8, 11, 14, or 17, wherein radially expanding and plastically deforming the tubular member using the adaptive expansion device comprises:

displacing the adaptive expansion device relative to the tubular member in the longitudinal direction.

25. The method of claims 2, 5, 8, 11, 14, or 17, wherein radially expanding and plastically deforming the tubular member using the adaptive expansion device comprises:

rotating the adaptive expansion device relative to the tubular member.

26. The method of claims 2, 5, 8, 11, 14, or 17, wherein radially expanding and plastically deforming the tubular member using the adaptive expansion device comprises:

applying a pressurized fluid to the interior surface of the tubular member.

27. The system of claims 3, 6, 9, 12, 15, or 18, wherein the means for radially expanding and plastically deforming the tubular member using the adaptive expansion device comprises:

means for displacing the adaptive expansion device.

28. The system of claim 27, wherein the means for displacing the adaptive expansion device comprises one or more degrees of freedom.

29. The system of claim 27, wherein the means for displacing the adaptive expansion device comprises a plurality of degrees of freedom.

30. The system of claims 3, 6, 9, 12, 15, or 18, wherein the means for radially expanding and plastically deforming the tubular member using the adaptive expansion device comprises:

means for radially expanding and plastically deforming the tubular member using a hydro-forming device.

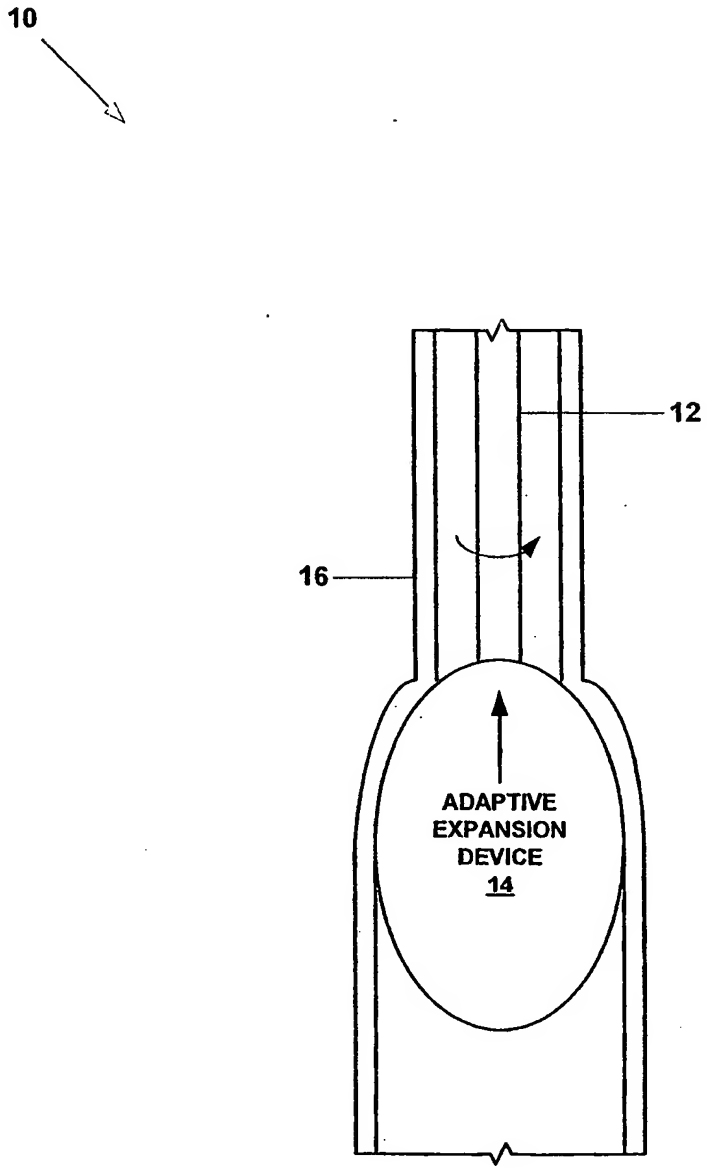

Fig. 1a

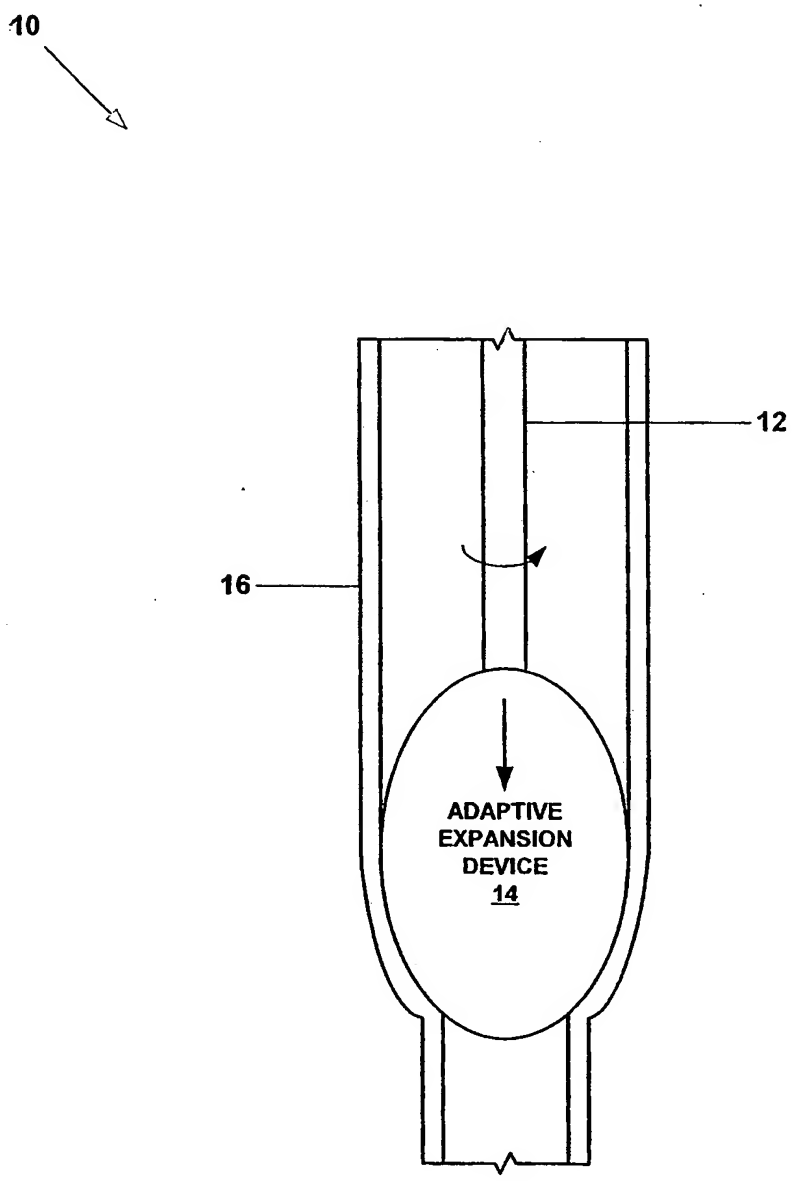

Fig. 1b

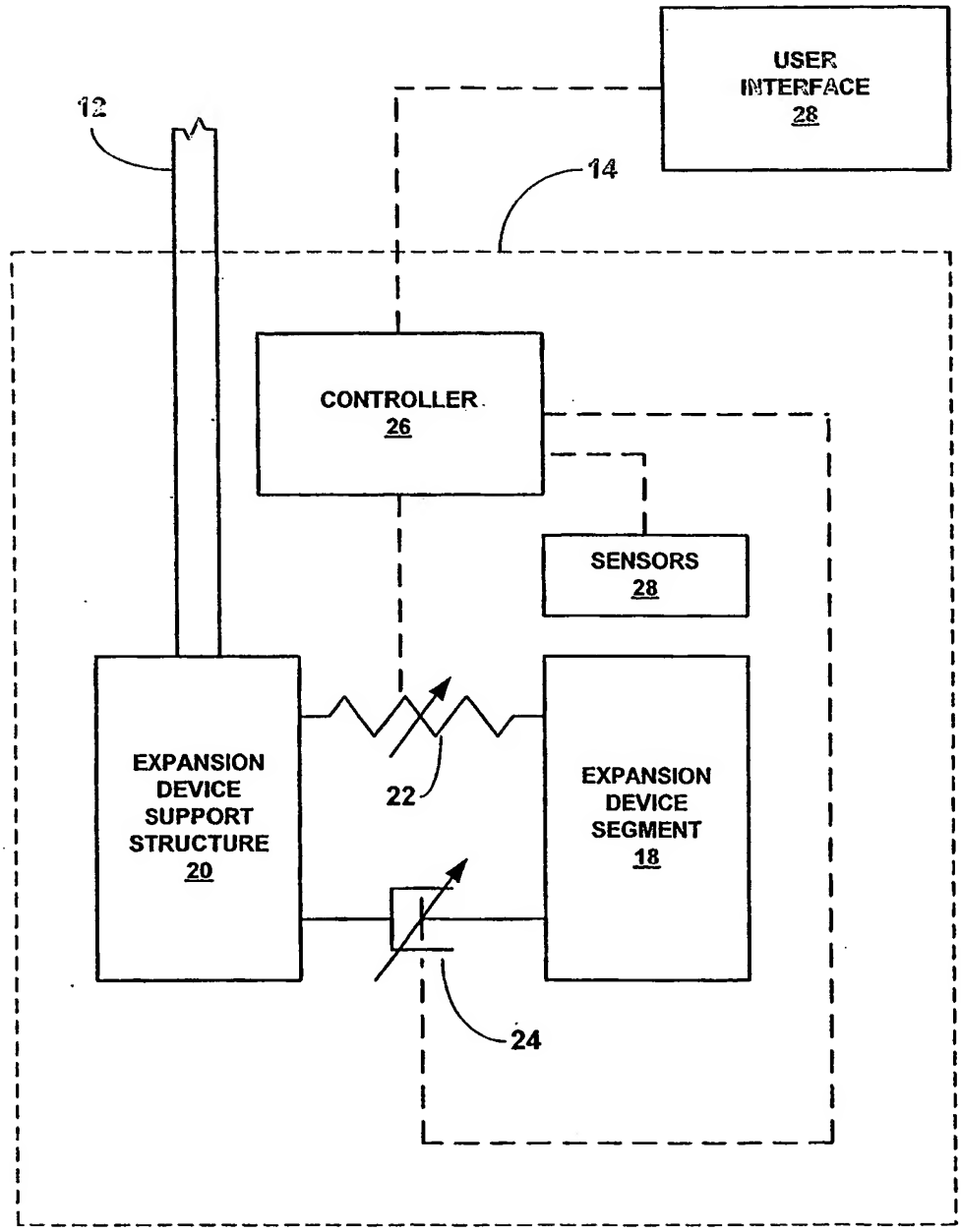
USER INTERFACE 28
12
14
CONTROLLER 26
SENSORS 28
EXPANSION DEVICE SUPPORT STRUCTURE 20
22
EXPANSION DEVICE SEGMENT 18
24

Fig. 2

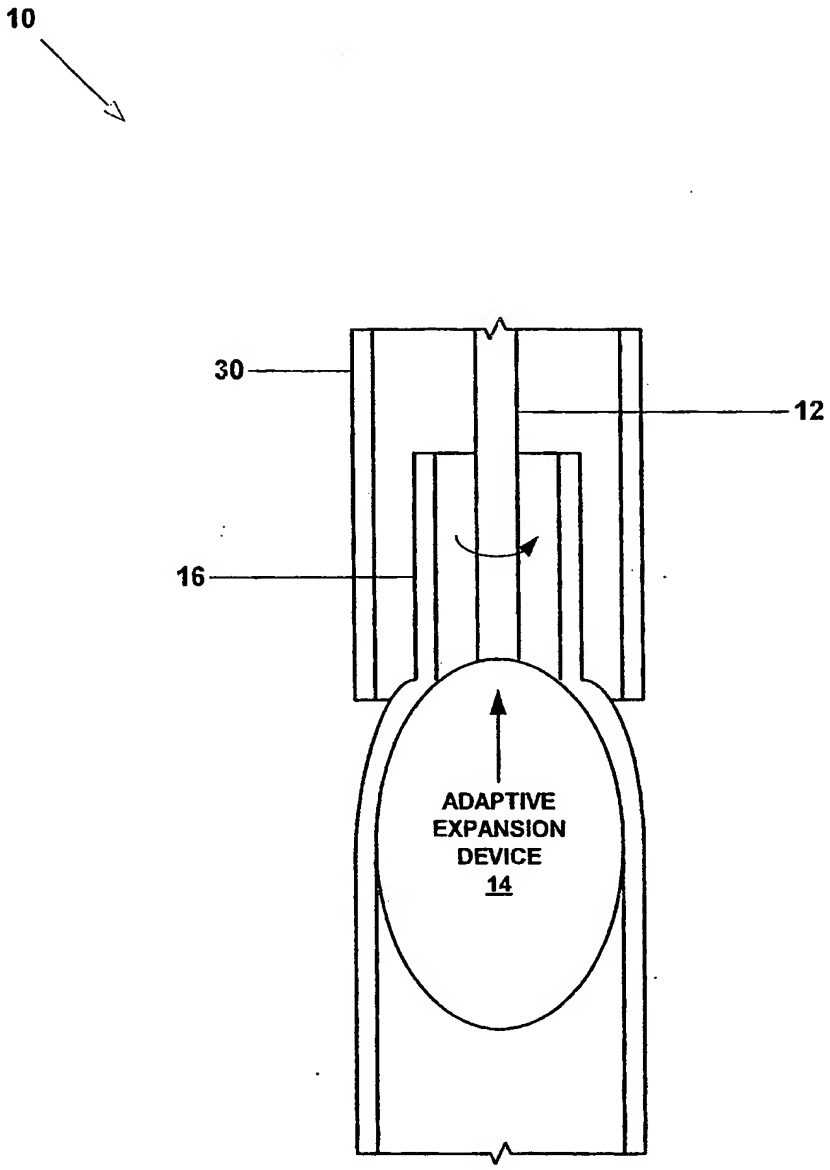

Fig. 3a

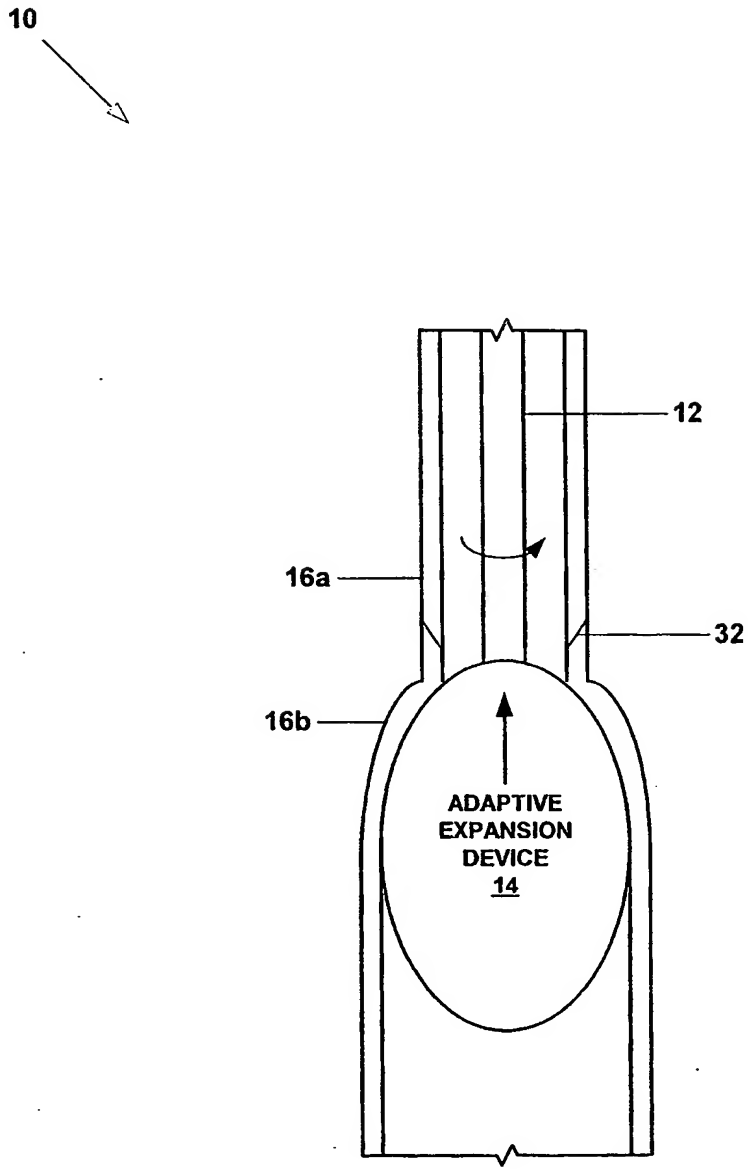

Fig. 3b

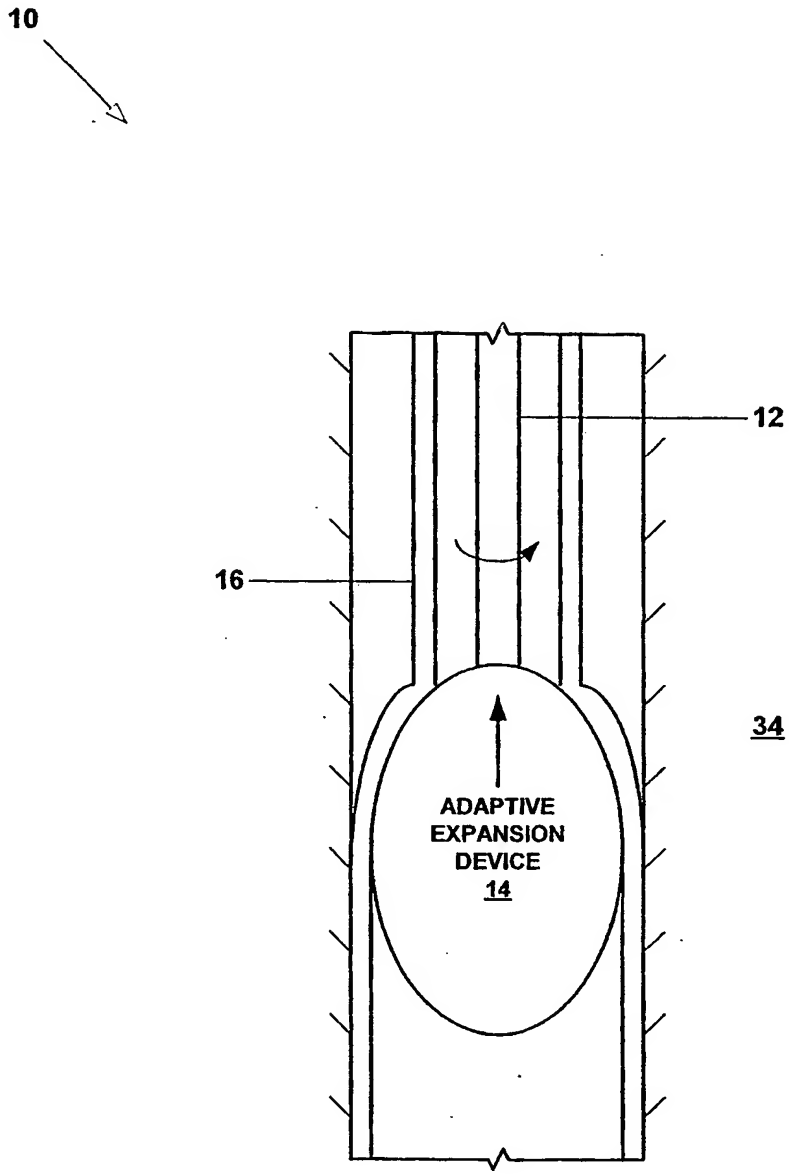

Fig. 3c

87. The apparatus of claim 86, wherein at least one of the expansion devices comprises an adjustable expansion device.

88. The apparatus of claim 87, wherein the adjustable expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

89. The apparatus of claim 88, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

90. The apparatus of claim 89, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

91. The apparatus of claim 90, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

92. The apparatus of claim 89, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

93. The apparatus of claim 92, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

94. The apparatus of claim 92, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

95. An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

a support member;

an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and

a sealing assembly for sealing an annulus defined between the support member and the tubular member.

96. The apparatus of claim 95, further comprising:
a gripping device for gripping the tubular member coupled to the support member.

97. The apparatus of claim 96, wherein the gripping device comprises a plurality of movable gripping elements.

98. The apparatus of claim 97, wherein the gripping elements are moveable in a radial direction relative to the support member.

99. The apparatus of claim 97, wherein the gripping elements are moveable in an axial direction relative to the support member.

100. The apparatus of claim 97, wherein the gripping elements are moveable in a radial and an axial direction relative to the support member.

101. The apparatus of claim 97, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member.

102. The apparatus of claim 97, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member.

103. The apparatus of claim 97, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not

engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member.

104. The apparatus of claim 97, wherein, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member.

105. The apparatus of claim 97, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position.

106. The apparatus of claim 97, wherein the gripping device further comprises:

an actuator for moving the gripping elements from a first position to a second position;

wherein in the first position, the gripping elements do not engage the tubular member;

wherein in the second position, the gripping elements do engage the tubular member; and

wherein the actuator is a fluid powered actuator.

107. The apparatus of claim 95, further comprising:

a locking device for locking the position of the tubular member relative to the support member.

108. The apparatus of claim 95, further comprising:

a packer assembly coupled to the support member.

109. The apparatus of claim 108, wherein the packer assembly comprises:

a packer; and

a packer control device for controlling the operation of the packer coupled to the support member.

110. The apparatus of claim 109, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve movably positioned within the passage of the support member.

111. The apparatus of claim 109, wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the packer.

112. The apparatus of claim 109, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve positioned within the passage of the support member; and
wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the sliding sleeve valve.

113. The apparatus of claim 95, further comprising:
an actuator for displacing the expansion device relative to the support member.

114. The apparatus of claim 113, wherein the actuator comprises:
a first actuator for pulling the expansion device; and
a second actuator for pushing the expansion device.

115. The apparatus of claim 113, wherein the actuator comprises means for transferring torsional loads between the support member and the expansion device.

116. The apparatus of claim 114, wherein the first and second actuators comprise means for transferring torsional loads between the support member and the expansion device.

117. The apparatus of claim 113, wherein the actuator comprises a plurality of pistons positioned within corresponding piston chambers.

118. The apparatus of claim 95, wherein the cutting device comprises:
a support member; and
a plurality of movable cutting elements coupled to the support member.

119. The apparatus of claim 118, further comprising:
an actuator coupled to the support member for moving the cutting elements between a first position and a second position;
wherein in the first position, the cutting elements do not engage the tubular member; and
wherein in the second position, the cutting elements engage the tubular member.

120. The apparatus of claim 119, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

121. The apparatus of claim 120, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

122. The apparatus of claim 119, wherein the cutting elements comprise:
a first set of cutting elements; and
a second set of cutting elements;
wherein the first set of cutting elements are interleaved with the second set of cutting elements.

123. The apparatus of claim 122, wherein in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements.

124. The apparatus of claim 122, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

125. The apparatus of claim 95, wherein the expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

126. The apparatus of claim 125, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

127. The apparatus of claim 126, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

128. The apparatus of claim 127, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

129. The apparatus of claim 126, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

130. The apparatus of claim 129, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

131. The apparatus of claim 129, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

132. The apparatus of claim 95, wherein the expansion device comprises an adjustable expansion device.

133. The apparatus of claim 95, wherein the expansion device comprises a plurality of expansion devices.

134. The apparatus of claim 133, wherein at least one of the expansion devices comprises an adjustable expansion device.

135. The apparatus of claim 134, wherein the adjustable expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

136. The apparatus of claim 135, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

137. The apparatus of claim 136, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

138. The apparatus of claim 137, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

139. The apparatus of claim 136, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

140. The apparatus of claim 139, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

141. The apparatus of claim 139, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

142. An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:
a support member;

a first expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and

a second expansion device for radially expanding and plastically deforming the tubular member coupled to the support member.

143. The apparatus of claim 142, further comprising:

a gripping device for gripping the tubular member coupled to the support member.

144. The apparatus of claim 143, wherein the gripping device comprises a plurality of movable gripping elements.

145. The apparatus of claim 144, wherein the gripping elements are moveable in a radial direction relative to the support member.

146. The apparatus of claim 144, wherein the gripping elements are moveable in an axial direction relative to the support member.

147. The apparatus of claim 144, wherein the gripping elements are moveable in a radial and an axial direction relative to the support member.

148. The apparatus of claim 144, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member.

149. The apparatus of claim 144, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member.

150. The apparatus of claim 144, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do

engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member.

151. The apparatus of claim 144, wherein, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member.

152. The apparatus of claim 144, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position.

153. The apparatus of claim 144, wherein the gripping device further comprises:

an actuator for moving the gripping elements from a first position to a second position;

wherein in the first position, the gripping elements do not engage the tubular member;

wherein in the second position, the gripping elements do engage the tubular member; and

wherein the actuator is a fluid powered actuator.

154. The apparatus of claim 142, further comprising:

a sealing device for sealing an interface with the tubular member coupled to the support member.

155. The apparatus of claim 154, wherein the sealing device seals an annulus defines between the support member and the tubular member.

156. The apparatus of claim 142, further comprising:

a locking device for locking the position of the tubular member relative to the support member.

157. The apparatus of claim 142, further comprising:

a packer assembly coupled to the support member.

158. The apparatus of claim 157, wherein the packer assembly comprises:
a packer; and
a packer control device for controlling the operation of the packer coupled to the support member.

159. The apparatus of claim 158, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve movably positioned within the passage of the support member.

160. The apparatus of claim 158, wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the packer.

161. The apparatus of claim 158, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve positioned within the passage of the support member; and
wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the sliding sleeve valve.

162. The apparatus of claim 142, further comprising:
an actuator for displacing the expansion device relative to the support member.

163. The apparatus of claim 162, wherein the actuator comprises:
a first actuator for pulling the expansion device; and
a second actuator for pushing the expansion device.

164. The apparatus of claim 162, wherein the actuator comprises means for transferring torsional loads between the support member and the expansion device.

165. The apparatus of claim 163, wherein the first and second actuators comprise means for transferring torsional loads between the support member and the expansion device.

166. The apparatus of claim 162, wherein the actuator comprises a plurality of pistons positioned within corresponding piston chambers.

167. The apparatus of claim 142, further comprising:
a cutting device for cutting the tubular member coupled to the support member.

168. The apparatus of claim 167, wherein the cutting device comprises:
a support member; and
a plurality of movable cutting elements coupled to the support member.

169. The apparatus of claim 168, further comprising:
an actuator coupled to the support member for moving the cutting elements between a first position and a second position;
wherein in the first position, the cutting elements do not engage the tubular member; and
wherein in the second position, the cutting elements engage the tubular member.

170. The apparatus of claim 169, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

171. The apparatus of claim 170, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

172. The apparatus of claim 169, wherein the cutting elements comprise:
a first set of cutting elements; and
a second set of cutting elements;
wherein the first set of cutting elements are interleaved with the second set of cutting elements.

173. The apparatus of claim 172, wherein in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements.

174. The apparatus of claim 172, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

175. The apparatus of claim 142, wherein at least one of the first second expansion devices comprise:
a support member; and
a plurality of movable expansion elements coupled to the support member.

176. The apparatus of claim 175, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

177. The apparatus of claim 176, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

178. The apparatus of claim 177, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

179. The apparatus of claim 176, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

180. The apparatus of claim 179, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

181. The apparatus of claim 179, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

182. The apparatus of claim 142, wherein at least one of the first and second expansion devices comprise a plurality of expansion devices.

183. The apparatus of claim 182, wherein at least one of the first and second expansion device comprise an adjustable expansion device.

184. The apparatus of claim 183, wherein the adjustable expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

185. The apparatus of claim 184, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

186. The apparatus of claim 185, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

187. The apparatus of claim 186, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

188. The apparatus of claim 185, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

189. The apparatus of claim 188, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

190. The apparatus of claim 188, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

191. An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

a support member;

an expansion device for radially expanding and plastically deforming the tubular member coupled to the support member; and

a packer coupled to the support member.

192. The apparatus of claim 191, further comprising:

a gripping device for gripping the tubular member coupled to the support member.

193. The apparatus of claim 192, wherein the gripping device comprises a plurality of movable gripping elements.

194. The apparatus of claim 193, wherein the gripping elements are moveable in a radial direction relative to the support member.

195. The apparatus of claim 193, wherein the gripping elements are moveable in an axial direction relative to the support member.

196. The apparatus of claim 193, wherein the gripping elements are moveable in a radial and an axial direction relative to the support member.

197. The apparatus of claim 193, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member.

198. The apparatus of claim 193, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the

second position, the gripping elements move in a radial direction relative to the support member.

199. The apparatus of claim 193, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member.

200. The apparatus of claim 193, wherein, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member.

201. The apparatus of claim 193, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position.

202. The apparatus of claim 193, wherein the gripping device further comprises:

an actuator for moving the gripping elements from a first position to a second position;

wherein in the first position, the gripping elements do not engage the tubular member;

wherein in the second position, the gripping elements do engage the tubular member; and

wherein the actuator is a fluid powered actuator.

203. The apparatus of claim 191, further comprising:

a sealing device for sealing an interface with the tubular member coupled to the support member.

204. The apparatus of claim 203, wherein the sealing device seals an annulus defines between the support member and the tubular member.

205. The apparatus of claim 191, further comprising:
a locking device for locking the position of the tubular member relative to the support member.

206. The apparatus of claim 191, wherein the packer assembly comprises:
a packer; and
a packer control device for controlling the operation of the packer coupled to the support member.

207. The apparatus of claim 206, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve movably positioned within the passage of the support member.

208. The apparatus of claim 206, wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the packer.

209. The apparatus of claim 206, wherein the packer comprises:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve positioned within the passage of the support member; and
wherein the packer control device comprises:
a support member;
one or more drag blocks releasably coupled to the support member; and
a stinger coupled to the support member for engaging the sliding sleeve valve.

210. The apparatus of claim 191, further comprising:
an actuator for displacing the expansion device relative to the support member.

211. The apparatus of claim 210, wherein the actuator comprises:
a first actuator for pulling the expansion device; and
a second actuator for pushing the expansion device.

214. The apparatus of claim 210, wherein the actuator comprises means for transferring torsional loads between the support member and the expansion device.

215. The apparatus of claim 211, wherein the first and second actuators comprise means for transferring torsional loads between the support member and the expansion device.

216. The apparatus of claim 210, wherein the actuator comprises a plurality of pistons positioned within corresponding piston chambers.

217. The apparatus of claim 191, further comprising a cutting device coupled to the support member for cutting the tubular member.

218. The apparatus of claim 217, wherein the cutting device comprises:
a support member; and
a plurality of movable cutting elements coupled to the support member.

219. The apparatus of claim 218, further comprising:
an actuator coupled to the support member for moving the cutting elements between a first position and a second position;
wherein in the first position, the cutting elements do not engage the tubular member; and
wherein in the second position, the cutting elements engage the tubular member.

220. The apparatus of claim 219, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

221. The apparatus of claim 220, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

222. The apparatus of claim 219, wherein the cutting elements comprise:
a first set of cutting elements; and

a second set of cutting elements;

wherein the first set of cutting elements are interleaved with the second set of cutting elements.

223. The apparatus of claim 222, wherein in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements.

224. The apparatus of claim 222, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

225. The apparatus of claim 191, wherein the expansion device comprises:

a support member; and

a plurality of movable expansion elements coupled to the support member.

226. The apparatus of claim 225, further comprising:

an actuator coupled to the support member for moving the expansion elements between a first position and a second position;

wherein in the first position, the expansion elements do not engage the tubular member; and

wherein in the second position, the expansion elements engage the tubular member.

227. The apparatus of claim 226, further comprising:

a sensor coupled to the support member for sensing the internal diameter of the tubular member.

228. The apparatus of claim 227, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

229. The apparatus of claim 226, wherein the expansion elements comprise:

a first set of expansion elements; and

a second set of expansion elements;

wherein the first set of expansion elements are interleaved with the second set of expansion elements.

230. The apparatus of claim 229, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

231. The apparatus of claim 229, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

232. The apparatus of claim 191, wherein the expansion device comprises an adjustable expansion device.

233. The apparatus of claim 191, wherein the expansion device comprises a plurality of expansion devices.

234. The apparatus of claim 233, wherein at least one of the expansion devices comprises an adjustable expansion device.

235. The apparatus of claim 234, wherein the adjustable expansion device comprises:
a support member; and
a plurality of movable expansion elements coupled to the support member.

236. The apparatus of claim 235, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

237. The apparatus of claim 236, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

238. The apparatus of claim 237, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

239. The apparatus of claim 236, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

240. The apparatus of claim 239, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

241. The apparatus of claim 239, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

242. An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

a support member;

a cutting device for cutting the tubular member coupled to the support member;

a gripping device for gripping the tubular member coupled to the support member;

a sealing device for sealing an interface with the tubular member coupled to the support member;

a locking device for locking the position of the tubular member relative to the support member;

a first adjustable expansion device for radially expanding and plastically deforming the tubular member coupled to the support member;

a second adjustable expansion device for radially expanding and plastically deforming the tubular member coupled to the support member;

a packer coupled to the support member; and

an actuator for displacing one or more of the sealing assembly, first and second adjustable expansion devices, and packer relative to the support member.

243. The apparatus of claim 242, wherein the gripping device comprises a plurality of movable gripping elements.

244. The apparatus of claim 243, wherein the gripping elements are moveable in a radial direction relative to the support member.

245. The apparatus of claim 243, wherein the gripping elements are moveable in an axial direction relative to the support member.

246. The apparatus of claim 243, wherein the gripping elements are moveable in a radial and an axial direction relative to the support member.

247. The apparatus of claim 243, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction relative to the support member.

248. The apparatus of claim 243, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction relative to the support member.

249. The apparatus of claim 243, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction relative to the support member.

250. The apparatus of claim 243, wherein, if the tubular member is displaced in a first axial direction, the gripping device grips the tubular member; and wherein, if the tubular member is displaced in a second axial direction, the gripping device does not grip the tubular member.

251. The apparatus of claim 243, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, the gripping elements are biased to remain in the first position.

252. The apparatus of claim 243, wherein the gripping device further comprises:

an actuator for moving the gripping elements from a first position to a second position;

wherein in the first position, the gripping elements do not engage the tubular member;

wherein in the second position, the gripping elements do engage the tubular member; and

wherein the actuator is a fluid powered actuator.

253. The apparatus of claim 242, wherein the sealing device seals an annulus defines between the support member and the tubular member.

254. The apparatus of claim 242, wherein the packer assembly comprises:

a packer; and

a packer control device for controlling the operation of the packer coupled to the support member.

255. The apparatus of claim 254, wherein the packer comprises:

a support member defining a passage;

a shoe comprising a float valve coupled to an end of the support member;

one or more compressible packer elements movably coupled to the support member; and

a sliding sleeve valve movably positioned within the passage of the support member.

256. The apparatus of claim 254, wherein the packer control device comprises:

a support member;

one or more drag blocks releasably coupled to the support member; and

a stinger coupled to the support member for engaging the packer.

257. The apparatus of claim 254, wherein the packer comprises:

a support member defining a passage;

a shoe comprising a float valve coupled to an end of the support member;

one or more compressible packer elements movably coupled to the support member; and

a sliding sleeve valve positioned within the passage of the support member; and

wherein the packer control device comprises:

a support member;

one or more drag blocks releasably coupled to the support member; and

a stinger coupled to the support member for engaging the sliding sleeve valve.

258. The apparatus of claim 242, wherein the actuator comprises:
a first actuator for pulling the expansion device; and
a second actuator for pushing the expansion device.

259. The apparatus of claim 242, wherein the actuator comprises means for transferring torsional loads between the support member and the expansion device.

260. The apparatus of claim 258, wherein the first and second actuators comprise means for transferring torsional loads between the support member and the expansion device.

261. The apparatus of claim 242, wherein the actuator comprises a plurality of pistons positioned within corresponding piston chambers.

262. The apparatus of claim 242, wherein the cutting device comprises:
a support member; and
a plurality of movable cutting elements coupled to the support member.

263. The apparatus of claim 262, further comprising:
an actuator coupled to the support member for moving the cutting elements between a first position and a second position;
wherein in the first position, the cutting elements do not engage the tubular member; and
wherein in the second position, the cutting elements engage the tubular member.

264. The apparatus of claim 263, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

265. The apparatus of claim 264, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

266. The apparatus of claim 263, wherein the cutting elements comprise:
a first set of cutting elements; and
a second set of cutting elements;
wherein the first set of cutting elements are interleaved with the second set of cutting elements.

267. The apparatus of claim 266, wherein in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements.

268. The apparatus of claim 266, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

269. The apparatus of claim 242, wherein at least one of the adjustable expansion devices comprise:
a support member; and
a plurality of movable expansion elements coupled to the support member.

270. The apparatus of claim 269, further comprising:
an actuator coupled to the support member for moving the expansion elements between a first position and a second position;
wherein in the first position, the expansion elements do not engage the tubular member; and
wherein in the second position, the expansion elements engage the tubular member.

271. The apparatus of claim 270, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

272. The apparatus of claim 271, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

273. The apparatus of claim 270, wherein the expansion elements comprise:
a first set of expansion elements; and
a second set of expansion elements;
wherein the first set of expansion elements are interleaved with the second set of expansion elements.

274. The apparatus of claim 273, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

275. The apparatus of claim 273, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

276. The apparatus of claim 242, wherein at least one of the adjustable expansion devices comprise a plurality of expansion devices.

277. The apparatus of claim 276, wherein at least one of the adjustable expansion devices comprise:

a support member; and

a plurality of movable expansion elements coupled to the support member.

278. The apparatus of claim 277, further comprising:

an actuator coupled to the support member for moving the expansion elements between a first position and a second position;

wherein in the first position, the expansion elements do not engage the tubular member; and

wherein in the second position, the expansion elements engage the tubular member.

279. The apparatus of claim 278, further comprising:

a sensor coupled to the support member for sensing the internal diameter of the tubular member.

280. The apparatus of claim 279, wherein the sensor prevents the expansion elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

281. The apparatus of claim 278, wherein the expansion elements comprise:

a first set of expansion elements; and

a second set of expansion elements;

wherein the first set of expansion elements are interleaved with the second set of expansion elements.

282. The apparatus of claim 281, wherein in the first position, the first set of expansion elements are not axially aligned with the second set of expansion elements.

283. The apparatus of claim 281, wherein in the second position, the first set of expansion elements are axially aligned with the second set of expansion elements.

284. An apparatus for cutting a tubular member, comprising:
a support member; and
a plurality of movable cutting elements coupled to the support member.

285. The apparatus of claim 284, further comprising:
an actuator coupled to the support member for moving the cutting elements between a first position and a second position;
wherein in the first position, the cutting elements do not engage the tubular member; and
wherein in the second position, the cutting elements engage the tubular member.

286. The apparatus of claim 285, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

287. The apparatus of claim 286, wherein the sensor prevents the cutting elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

288. The apparatus of claim 285, wherein the cutting elements comprise:
a first set of cutting elements; and
a second set of cutting elements;
wherein the first set of cutting elements are interleaved with the second set of cutting elements.

289. The apparatus of claim 288, wherein in the first position, the first set of cutting elements are not axially aligned with the second set of cutting elements.

290. The apparatus of claim 288, wherein in the second position, the first set of cutting elements are axially aligned with the second set of cutting elements.

291. An apparatus for engaging a tubular member, comprising:
a support member; and
a plurality of movable elements coupled to the support member.

292. The apparatus of claim 291, further comprising:
an actuator coupled to the support member for moving the elements between a first position and a second position;
wherein in the first position, the elements do not engage the tubular member; and
wherein in the second position, the elements engage the tubular member.

293. The apparatus of claim 292, further comprising:
a sensor coupled to the support member for sensing the internal diameter of the tubular member.

294. The apparatus of claim 293, wherein the sensor prevents the elements from being moved to the second position if the internal diameter of the tubular member is less than a predetermined value.

295. The apparatus of claim 292, wherein the elements comprise:
a first set of elements; and
a second set of elements;
wherein the first set of elements are interleaved with the second set of elements.

296. The apparatus of claim 295, wherein in the first position, the first set of elements are not axially aligned with the second set of elements.

297. The apparatus of claim 295, wherein in the second position, the first set of elements are axially aligned with the second set of elements.

298. An apparatus for gripping a tubular member, comprising:
a plurality of movable gripping elements.

299. The apparatus of claim 298, wherein the gripping elements are moveable in a radial direction.

300. The apparatus of claim 298, wherein the gripping elements are moveable in an axial direction.

301. The apparatus of claim 298, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do

engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial and an axial direction.

302. The apparatus of claim 298, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in a radial direction.

303. The apparatus of claim 298, wherein the gripping elements are moveable from a first position to a second position; wherein in the first position, the gripping elements do not engage the tubular member; wherein in the second position, the gripping elements do engage the tubular member; and wherein, during the movement from the first position to the second position, the gripping elements move in an axial direction.

304. The apparatus of claim 298, wherein, in a first axial direction, the gripping device grips the tubular member; and wherein, in a second axial direction, the gripping device does not grip the tubular member.

305. The apparatus of claim 298, further comprising an actuator for moving the gripping elements.

306. The apparatus of claim 298, wherein the gripping elements comprise:
a plurality of separate and distinct gripping elements.

307. An actuator, comprising:
a tubular housing;
a tubular piston rod movably coupled to and at least partially positioned within the housing;
a plurality of annular piston chambers defined by the tubular housing and the tubular piston rod; and
a plurality of tubular pistons coupled to the tubular piston rod, each tubular piston movably positioned within a corresponding annular piston chamber.

308. The actuator of claim 307, further comprising means for transmitting torsional loads between the tubular housing and the tubular piston rod.

309. An apparatus for controlling a packer, comprising:
a tubular support member;
one or more drag blocks releasably coupled to the tubular support member; and
a tubular stinger coupled to the tubular support member for engaging the packer.

310. The apparatus of claim 309, further comprising a tubular sleeve coupled to the drag blocks.

311. The apparatus of claim 309, wherein the tubular support member comprises one or more axially aligned teeth for engaging the packer.

312. A packer comprising:
a support member defining a passage;
a shoe comprising a float valve coupled to an end of the support member;
one or more compressible packer elements movably coupled to the support member; and
a sliding sleeve valve movably positioned within the passage of the support member.

313. A method of radially expanding and plastically deforming an expandable tubular member within a borehole having a preexisting wellbore casing, comprising:
positioning the tubular member within the borehole in overlapping relation to the wellbore casing;
radially expanding and plastically deforming a portion of the tubular member to form a bell section; and
radially expanding and plastically deforming a portion of the tubular member above the bell section comprising a portion of the tubular member that overlaps with the wellbore casing;
wherein the inside diameter of the bell section is greater than the inside diameter of the radially expanded and plastically deformed portion of the tubular member above the bell section.

314. The method of claim 313, wherein radially expanding and plastically deforming a portion of the tubular member to form a bell section comprises:
positioning an adjustable expansion device within the expandable tubular member;
supporting the expandable tubular member and the adjustable expansion device within the borehole;
lowering the adjustable expansion device out of the expandable tubular member;

increasing the outside dimension of the adjustable expansion device; and

displacing the adjustable expansion device upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member, wherein n is greater than or equal to 1.

315. A method for forming a mono diameter wellbore casing, comprising:

positioning an adjustable expansion device within a first expandable tubular member;

supporting the first expandable tubular member and the adjustable expansion device within a borehole;

lowering the adjustable expansion device out of the first expandable tubular member;

increasing the outside dimension of the adjustable expansion device;

displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole;

positioning the adjustable expansion device within a second expandable tubular member;

supporting the second expandable tubular member and the adjustable expansion device within the borehole in overlapping relation to the first expandable tubular member;

lowering the adjustable expansion device out of the second expandable tubular member;

increasing the outside dimension of the adjustable expansion device; and

displacing the adjustable expansion device upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole.

316. A method for radially expanding and plastically deforming an expandable tubular member within a borehole, comprising:

positioning an adjustable expansion device within the expandable tubular member;

supporting the expandable tubular member and the adjustable expansion device within the borehole;

lowering the adjustable expansion device out of the expandable tubular member;

increasing the outside dimension of the adjustable expansion device;

displacing the adjustable expansion mandrel upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member within the borehole; and

pressurizing an interior region of the expandable tubular member above the

adjustable expansion device during the radial expansion and plastic deformation of the expandable tubular member within the borehole.

317. A method for forming a mono diameter wellbore casing, comprising:

positioning an adjustable expansion device within a first expandable tubular member;

supporting the first expandable tubular member and the adjustable expansion device within a borehole;

lowering the adjustable expansion device out of the first expandable tubular member;

increasing the outside dimension of the adjustable expansion device;

displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole;

pressurizing an interior region of the first expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the first expandable tubular member within the borehole;

positioning the adjustable expansion mandrel within a second expandable tubular member;

supporting the second expandable tubular member and the adjustable expansion mandrel within the borehole in overlapping relation to the first expandable tubular member;

lowering the adjustable expansion mandrel out of the second expandable tubular member;

increasing the outside dimension of the adjustable expansion mandrel;

displacing the adjustable expansion mandrel upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole; and

pressurizing an interior region of the second expandable tubular member above the adjustable expansion mandrel during the radial expansion and plastic deformation of the second expandable tubular member within the borehole.

318. A method for radially expanding and plastically deforming an expandable tubular member within a borehole, comprising:

positioning first and second adjustable expansion devices within the expandable tubular member;

supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole;

lowering the first adjustable expansion device out of the expandable tubular member;

increasing the outside dimension of the first adjustable expansion device;

displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member;

displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member;

decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member;

wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

319. A method for forming a mono diameter wellbore casing, comprising:

positioning first and second adjustable expansion devices within a first expandable tubular member;

supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole;

lowering the first adjustable expansion device out of the first expandable tubular member;

increasing the outside dimension of the first adjustable expansion device;

displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member;

displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member;

decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member;

positioning first and second adjustable expansion devices within a second expandable tubular member;

supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member;

lowering the first adjustable expansion device out of the second expandable tubular member;

increasing the outside dimension of the first adjustable expansion device;

displacing the first adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member;

displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member;

decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; and

displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member;

wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

320. A method for radially expanding and plastically deforming an expandable tubular member within a borehole, comprising:

positioning first and second adjustable expansion devices within the expandable tubular member;

supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole;

lowering the first adjustable expansion device out of the expandable tubular member;

increasing the outside dimension of the first adjustable expansion device;

displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member;

pressurizing an interior region of the expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the expandable tubular member by the first adjustable expansion device;

displacing the first adjustable expansion device and the second adjustable expansion

device downwardly relative to the expandable tubular member;

decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; and

pressurizing an interior region of the expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the expandable tubular member above the lower portion of the expandable tubular member by the second adjustable expansion device;

wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

321. A method for forming a mono diameter wellbore casing, comprising:

positioning first and second adjustable expansion devices within a first expandable tubular member;

supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole;

lowering the first adjustable expansion device out of the first expandable tubular member;

increasing the outside dimension of the first adjustable expansion device;

displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member;

pressurizing an interior region of the first expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the first expandable tubular member by the first adjustable expansion device;

displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member;

decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member;

pressurizing an interior region of the first expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the first expandable tubular member above the lower portion of the first expandable tubular member by the second adjustable expansion device;

positioning first and second adjustable expansion devices within a second expandable tubular member;

supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member;

lowering the first adjustable expansion device out of the second expandable tubular member;

increasing the outside dimension of the first adjustable expansion device;

displacing the first adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member;

pressurizing an interior region of the second expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the second expandable tubular member by the first adjustable expansion device;

displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member;

decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member; and

pressurizing an interior region of the second expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the second expandable tubular member above the lower portion of the second expandable tubular member by the second adjustable expansion device;

wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

322. A method for radially expanding and plastically deforming an expandable tubular member within a borehole, comprising:

supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole;

increasing the size of the adjustable expansion device; and

displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member.

323. The method of claim 322, further comprising:

reducing the size of the adjustable expansion device after the portion of the expandable tubular member has been radially expanded and plastically deformed.

324. The method of claim 323, further comprising:

fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member after reducing the size of the adjustable expansion device.

325. The method of claim 324, further comprising:

permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator after fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member.

326. The method of claim 325, further comprising:

injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and a preexisting structure after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

327. The method of claim 325, further comprising:

increasing the size of the adjustable expansion device after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

328. The method of claim 327, further comprising:

displacing the adjustable expansion cone upwardly relative to the expandable tubular member to radially expand and plastically deform another portion of the expandable tubular member.

329. The method of claim 328, further comprising:
if the end of the other portion of the expandable tubular member overlaps with a preexisting structure, then
not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator; and
displacing the adjustable expansion cone upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform the end of the other portion of the expandable tubular member that overlaps with the preexisting structure.

330. A method for forming a mono diameter wellbore casing within a borehole that includes a preexisting wellbore casing, comprising:
supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole;
increasing the size of the adjustable expansion device;
displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member; and
displacing the adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member and a portion of the preexisting wellbore casing that overlaps with an end of the remaining portion of the expandable tubular member.

331. The method of claim 330, further comprising:
reducing the size of the adjustable expansion device after the portion of the expandable tubular member has been radially expanded and plastically deformed.

332. The method of claim 331, further comprising:
fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member after reducing the size of the adjustable expansion device.

333. The method of claim 332, further comprising:

permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator after fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member.

334. The method of claim 333, further comprising:

injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and the borehole after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

335. The method of claim 333, further comprising:

increasing the size of the adjustable expansion device after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

336. The method of claim 335, further comprising:

displacing the adjustable expansion cone upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member.

337. The method of claim 336, further comprising:

not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator; and

displacing the adjustable expansion cone upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform the end of the remaining portion of the expandable tubular member that overlaps with the preexisting wellbore casing after not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

338. A method of radially expanding and plastically deforming a tubular member, comprising:

positioning the tubular member within a preexisting structure;

radially expanding and plastically deforming a lower portion of the tubular member to form a bell section; and

radially expanding and plastically deforming a portion of the tubular member above the bell section.

339. The method of claim 338, wherein positioning the tubular member within a preexisting structure comprises:

locking the tubular member to an expansion device.

340. The method of claim 339, wherein the outside diameter of the expansion device is less than the inside diameter of the tubular member.

341. The method of claim 339, wherein the expansion device is positioned within the tubular member.

342. The method of claim 339, wherein the expansion device comprises an adjustable expansion device.

343. The method of claim 342, wherein the adjustable expansion device is adjustable to a plurality of sizes.

344. The method of claim 339, wherein the expansion device comprises a plurality of expansion devices.

345. The method of claim 344, wherein at least one of the expansion devices comprises an adjustable expansion device.

346. The method of claim 345, wherein at least one of the adjustable expansion device is adjustable to a plurality of sizes.

347. The method of claim 338, wherein radially expanding and plastically deforming a lower portion of the tubular member to form a bell section comprises:

lowering an expansion device out of an end of the tubular member; and

pulling the expansion device through the end of the tubular member.

348. The method of claim 347, wherein lowering an expansion device out of an end of the tubular member comprises:

lowering the expansion device out of the end of the tubular member; and

adjusting the size of the expansion device.

349. The method of claim 348, wherein the adjustable expansion device is adjustable to a plurality of sizes.

350. The method of claim 348, wherein the expansion device comprises a plurality of adjustable expansion devices.

351. The method of claim 350, wherein at least one of the adjustable expansion devices is adjustable to a plurality of sizes.

352. The method of claim 347, wherein pulling the expansion device through the end of the tubular member comprises:

gripping the tubular member; and

pulling an expansion device through an end of the tubular member.

353. The method of claim 352, wherein gripping the tubular member comprises:

permitting axial displacement of the tubular member in a first direction; and

not permitting axial displacement of the tubular member in a second direction.

354. The method of claim 352, wherein pulling the expansion device through the end of the tubular member comprises:

pulling the expansion device through the end of the tubular member using an actuator.

355. The method of claim 338, wherein radially expanding and plastically deforming a portion of the tubular member above the bell section comprises:

lowering an expansion device out of an end of the tubular member; and

pulling the expansion device through the end of the tubular member.

356. The method of claim 355, wherein lowering an expansion device out of an end of the tubular member comprises:

lowering the expansion device out of the end of the tubular member; and

adjusting the size of the expansion device.

357. The method of claim 356, wherein the adjustable expansion device is adjustable to a plurality of sizes.

358. The method of claim 356, wherein the expansion device comprises a plurality of adjustable expansion devices.

359. The method of claim 358, wherein at least one of the adjustable expansion devices is adjustable to a plurality of sizes.

360. The method of claim 355, wherein pulling the expansion device through the end of the tubular member comprises:

gripping the tubular member; and

pulling an expansion device through an end of the tubular member.

361. The method of claim 360, wherein gripping the tubular member comprises:

permitting axial displacement of the tubular member in a first direction; and

not permitting axial displacement of the tubular member in a second direction.

362. The method of claim 360, wherein pulling the expansion device through the end of the tubular member comprises:

pulling the expansion device through the end of the tubular member using an actuator.

363. The method of claim 355, wherein pulling the expansion device through the end of the tubular member comprises:

pulling the expansion device through the end of the tubular member using fluid pressure.

364. The method of claim 363, wherein pulling the expansion device through the end of the tubular member using fluid pressure comprises:

pressurizing an annulus within the tubular member above the expansion device.

365. The method of claim 338, wherein radially expanding and plastically deforming a portion of the tubular member above the bell section comprises:

fluidicly sealing an end of the tubular member; and

pulling the expansion device through the tubular member.

366. The method of claim 365, wherein the expansion device is adjustable.

367. The method of claim 366, wherein the expansion device is adjustable to a plurality of sizes.

368. The method of claim 365, wherein the expansion device comprises a plurality of adjustable expansion devices.

369. The method of claim 368, wherein at least one of the adjustable expansion devices is adjustable to a plurality of sizes.

370. The method of claim 365, wherein pulling the expansion device through the end of the tubular member comprises:

gripping the tubular member; and

pulling an expansion device through an end of the tubular member.

371. The method of claim 370, wherein gripping the tubular member comprises:

permitting axial displacement of the tubular member in a first direction; and

not permitting axial displacement of the tubular member in a second direction.

372. The method of claim 370, wherein pulling the expansion device through the end of the tubular member comprises:

pulling the expansion device through the end of the tubular member using an actuator.

373. The method of claim 365, wherein pulling the expansion device through the end of the tubular member comprises:

pulling the expansion device through the end of the tubular member using fluid pressure.

374. The method of claim 373, wherein pulling the expansion device through the end of the tubular member using fluid pressure comprises:

pressurizing an annulus within the tubular member above the expansion device.

375. The method of claim 338, wherein radially expanding and plastically deforming a portion of the tubular member above the bell section comprises:

overlapping the portion of the tubular member above the bell section with an end of a preexisting tubular member; and

pulling an expansion device through the overlapping portions of the tubular member and the preexisting tubular member.

376. The method of claim 375, wherein the expansion device is adjustable.

377. The method of claim 376, wherein the expansion device is adjustable to a plurality of sizes.

378. The method of claim 375, wherein the expansion device comprises a plurality of adjustable expansion devices.

379. The method of claim 378, wherein at least one of the adjustable expansion devices is adjustable to a plurality of sizes.

380. The method of claim 375, wherein pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member comprises:

gripping the tubular member; and

pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member.

381. The method of claim 380, wherein gripping the tubular member comprises:

permitting axial displacement of the tubular member in a first direction; and

not permitting axial displacement of the tubular member in a second direction.

382. The method of claim 380, wherein pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member comprises:

pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using an actuator.

383. The method of claim 375, wherein pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member comprises:

pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using fluid pressure.

384. The method of claim 383, wherein pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using fluid pressure comprises:

pressurizing an annulus within the tubular member above the expansion device.

385. The method of claim 375, further comprising:

cutting an end of the portion of the tubular member that overlaps with the preexisting tubular member.

386. The method of claim 385, further comprising:

removing the cut off end of the expandable tubular member from the preexisting structure.

387. The method of claim 338, further comprising:

injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and the preexisting structure.

388. The method of claim 338, further comprising:

cutting off an end of the expandable tubular member.

389. The method of claim 388, further comprising:

removing the cut off end of the expandable tubular member from the preexisting structure.

390. A method of radially expanding and plastically deforming a tubular member, comprising:

applying internal pressure to the inside surface of the tubular member at a plurality of discrete location separated from one another.

391. A system for radially expanding and plastically deforming an expandable tubular member within a borehole having a preexisting wellbore casing, comprising:

means for positioning the tubular member within the borehole in overlapping relation to the wellbore casing;

means for radially expanding and plastically deforming a portion of the tubular member to form a bell section; and

means for radially expanding and plastically deforming a portion of the tubular member above the bell section comprising a portion of the tubular member that overlaps with the wellbore casing;

wherein the inside diameter of the bell section is greater than the inside diameter of the radially expanded and plastically deformed portion of the tubular member above the bell section.

392. The system of claim 391, wherein means for radially expanding and plastically deforming a portion of the tubular member to form a bell section comprises:

means for positioning an adjustable expansion device within the expandable tubular member;

means for supporting the expandable tubular member and the adjustable expansion device within the borehole;

means for lowering the adjustable expansion device out of the expandable tubular member;

means for increasing the outside dimension of the adjustable expansion device; and

means for displacing the adjustable expansion device upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member, wherein n is greater than or equal to 1.

393. A system for forming a mono diameter wellbore casing, comprising:

means for positioning an adjustable expansion device within a first expandable tubular member;

means for supporting the first expandable tubular member and the adjustable expansion device within a borehole;

means for lowering the adjustable expansion device out of the first expandable tubular member;

means for increasing the outside dimension of the adjustable expansion device;

means for displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole;

means for positioning the adjustable expansion device within a second expandable tubular member;

means for supporting the second expandable tubular member and the adjustable expansion device within the borehole in overlapping relation to the first expandable tubular member;

means for lowering the adjustable expansion device out of the second expandable tubular member;

means for increasing the outside dimension of the adjustable expansion device; and

means for displacing the adjustable expansion device upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole.

394. A system for radially expanding and plastically deforming an expandable tubular member within a borehole, comprising:

means for positioning an adjustable expansion device within the expandable tubular member;

means for supporting the expandable tubular member and the adjustable expansion device within the borehole;

means for lowering the adjustable expansion device out of the expandable tubular member;

means for increasing the outside dimension of the adjustable expansion device;

means for displacing the adjustable expansion mandrel upwardly relative to the expandable tubular member n times to radially expand and plastically deform n portions of the expandable tubular member within the borehole; and

means for pressurizing an interior region of the expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the expandable tubular member within the borehole.

395. A system for forming a mono diameter wellbore casing, comprising:

means for positioning an adjustable expansion device within a first expandable tubular member;

means for supporting the first expandable tubular member and the adjustable expansion device within a borehole;

means for lowering the adjustable expansion device out of the first expandable tubular member;

means for increasing the outside dimension of the adjustable expansion device;

means for displacing the adjustable expansion device upwardly relative to the first expandable tubular member m times to radially expand and plastically deform m portions of the first expandable tubular member within the borehole;

means for pressurizing an interior region of the first expandable tubular member above the adjustable expansion device during the radial expansion and plastic deformation of the first expandable tubular member within the borehole;

means for positioning the adjustable expansion mandrel within a second expandable tubular member;

means for supporting the second expandable tubular member and the adjustable expansion mandrel within the borehole in overlapping relation to the first expandable tubular member;

means for lowering the adjustable expansion mandrel out of the second expandable tubular member;

means for increasing the outside dimension of the adjustable expansion mandrel;

means for displacing the adjustable expansion mandrel upwardly relative to the second expandable tubular member n times to radially expand and plastically deform n portions of the second expandable tubular member within the borehole; and

means for pressurizing an interior region of the second expandable tubular member above the adjustable expansion mandrel during the radial expansion and plastic deformation of the second expandable tubular member within the borehole.

396. A system for radially expanding and plastically deforming an expandable tubular member within a borehole, comprising:

means for positioning first and second adjustable expansion devices within the expandable tubular member;

means for supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole;

means for lowering the first adjustable expansion device out of the expandable tubular member;

means for increasing the outside dimension of the first adjustable expansion device;

means for displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member;

means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member;

means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

means for displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member;

wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

397. A system for forming a mono diameter wellbore casing, comprising:

means for positioning first and second adjustable expansion devices within a first expandable tubular member;

means for supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole;

means for lowering the first adjustable expansion device out of the first expandable tubular member;

means for increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member;

means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member;

means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

means for displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member;

means for positioning first and second adjustable expansion devices within a second expandable tubular member;

means for supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member;

means for lowering the first adjustable expansion device out of the second expandable tubular member;

means for increasing the outside dimension of the first adjustable expansion device; displacing the first adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member;

means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member;

means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device; and

means for displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member;

wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

398. A system for radially expanding and plastically deforming an expandable tubular member within a borehole, comprising:

means for positioning first and second adjustable expansion devices within the expandable tubular member;

means for supporting the expandable tubular member and the first and second adjustable expansion devices within the borehole;

means for lowering the first adjustable expansion device out of the expandable tubular member;

means for increasing the outside dimension of the first adjustable expansion device;

means for displacing the first adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform a lower portion of the expandable tubular member;

means for pressurizing an interior region of the expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the expandable tubular member by the first adjustable expansion device;

means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the expandable tubular member;

means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

means for displacing the second adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform portions of the expandable tubular member above the lower portion of the expandable tubular member; and

means for pressurizing an interior region of the expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the expandable tubular member above the lower portion of the expandable tubular member by the second adjustable expansion device;

wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

399. A system for forming a mono diameter wellbore casing, comprising:

means for positioning first and second adjustable expansion devices within a first expandable tubular member;

means for supporting the first expandable tubular member and the first and second adjustable expansion devices within a borehole;

means for lowering the first adjustable expansion device out of the first expandable tubular member;

means for increasing the outside dimension of the first adjustable expansion device;

displacing the first adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform a lower portion of the first expandable tubular member;

means for pressurizing an interior region of the first expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the first expandable tubular member by the first adjustable expansion device;

means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the first expandable tubular member;

means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

means for displacing the second adjustable expansion device upwardly relative to the first expandable tubular member to radially expand and plastically deform portions of the first expandable tubular member above the lower portion of the expandable tubular member;

means for pressurizing an interior region of the first expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the first expandable tubular member above the lower portion of the first expandable tubular member by the second adjustable expansion device;

means for positioning first and second adjustable expansion devices within a second expandable tubular member;

means for supporting the first expandable tubular member and the first and second adjustable expansion devices within the borehole in overlapping relation to the first expandable tubular member;

means for lowering the first adjustable expansion device out of the second expandable tubular member;

means for increasing the outside dimension of the first adjustable expansion device;

means for displacing the first adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform a lower portion of the second expandable tubular member;

means for pressurizing an interior region of the second expandable tubular member above the first adjustable expansion device during the radial expansion of the lower portion of the second expandable tubular member by the first adjustable expansion device;

means for displacing the first adjustable expansion device and the second adjustable expansion device downwardly relative to the second expandable tubular member;

means for decreasing the outside dimension of the first adjustable expansion device and increasing the outside dimension of the second adjustable expansion device;

means for displacing the second adjustable expansion device upwardly relative to the second expandable tubular member to radially expand and plastically deform portions of the second expandable tubular member above the lower portion of the second expandable tubular member; and

means for pressurizing an interior region of the second expandable tubular member above the second adjustable expansion device during the radial expansion of the portions of the second expandable tubular member above the lower portion of the second expandable tubular member by the second adjustable expansion device;

wherein the outside dimension of the first adjustable expansion device is greater than the outside dimension of the second adjustable expansion device.

400. A system for radially expanding and plastically deforming an expandable tubular member within a borehole, comprising:

means for supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole;

means for increasing the size of the adjustable expansion device; and

means for displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member.

401. The system of claim 400, further comprising:
means for reducing the size of the adjustable expansion device after the portion of the expandable tubular member has been radially expanded and plastically deformed.

402. The system of claim 401, further comprising:
means for fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member after reducing the size of the adjustable expansion device.

403. The system of claim 402, further comprising:
means for permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator after fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member.

404. The system of claim 403, further comprising:
means for injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and a preexisting structure after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

405. The system of claim 403, further comprising:
means for increasing the size of the adjustable expansion device after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

406. The system of claim 405, further comprising:
means for displacing the adjustable expansion cone upwardly relative to the expandable tubular member to radially expand and plastically deform another portion of the expandable tubular member.

407. The system of claim 406, further comprising:
if the end of the other portion of the expandable tubular member overlaps with a preexisting structure, then
means for not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator; and

means for displacing the adjustable expansion cone upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform the end of the other portion of the expandable tubular member that overlaps with the preexisting structure.

408. A system for forming a mono diameter wellbore casing within a borehole that includes a preexisting wellbore casing, comprising:
means for supporting the expandable tubular member, an hydraulic actuator, and an adjustable expansion device within the borehole;
means for increasing the size of the adjustable expansion device;
means for displacing the adjustable expansion device upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform a portion of the expandable tubular member; and
means for displacing the adjustable expansion device upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member and a portion of the preexisting wellbore casing that overlaps with an end of the remaining portion of the expandable tubular member.

409. The system of claim 408, further comprising:
means for reducing the size of the adjustable expansion device after the portion of the expandable tubular member has been radially expanded and plastically deformed.

410. The system of claim 409, further comprising:
means for fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member after reducing the size of the adjustable expansion device.

411. The system of claim 410, further comprising:
means for permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator after fluidicly sealing the radially expanded and plastically deformed end of the expandable tubular member.

412. The system of claim 411, further comprising:
means for injecting a hardenable fluidic sealing material into an annulus between the

expandable tubular member and the borehole after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

413. The system of claim 411, further comprising:

means for increasing the size of the adjustable expansion device after permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

414. The system of claim 413, further comprising:

means for displacing the adjustable expansion cone upwardly relative to the expandable tubular member to radially expand and plastically deform the remaining portion of the expandable tubular member.

415. The system of claim 414, further comprising:

means for not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator; and

means for displacing the adjustable expansion cone upwardly relative to the expandable tubular member using the hydraulic actuator to radially expand and plastically deform the end of the remaining portion of the expandable tubular member that overlaps with the preexisting wellbore casing after not permitting the position of the expandable tubular member to float relative to the position of the hydraulic actuator.

416. A system for radially expanding and plastically deforming a tubular member, comprising:

means for positioning the tubular member within a preexisting structure;

means for radially expanding and plastically deforming a lower portion of the tubular member to form a bell section; and

means for radially expanding and plastically deforming a portion of the tubular member above the bell section.

417. The system of claim 416, wherein positioning the tubular member within a preexisting structure comprises:

means for locking the tubular member to an expansion device.

418. The system of claim 417, wherein the outside diameter of the expansion device is less than the inside diameter of the tubular member.

419. The system of claim 417, wherein the expansion device is positioned within the tubular member.

420. The system of claim 417, wherein the expansion device comprises an adjustable expansion device.

421. The system of claim 420, wherein the adjustable expansion device is adjustable to a plurality of sizes.

422. The system of claim 417, wherein the expansion device comprises a plurality of expansion devices.

423. The system of claim 422, wherein at least one of the expansion devices comprises an adjustable expansion device.

424. The system of claim 423, wherein at least one of the adjustable expansion device is adjustable to a plurality of sizes.

425. The system of claim 416, wherein means for radially expanding and plastically deforming a lower portion of the tubular member to form a bell section comprises:

means for lowering an expansion device out of an end of the tubular member; and

means for pulling the expansion device through the end of the tubular member.

426. The system of claim 425, wherein means for lowering an expansion device out of an end of the tubular member comprises:

means for lowering the expansion device out of the end of the tubular member; and

means for adjusting the size of the expansion device.

427. The system of claim 426, wherein the adjustable expansion device is adjustable to a plurality of sizes.

428. The system of claim 426, wherein the expansion device comprises a plurality of adjustable expansion devices.

429. The system of claim 428, wherein at least one of the adjustable expansion devices is adjustable to a plurality of sizes.

430. The system of claim 425, wherein means for pulling the expansion device through the end of the tubular member comprises:

means for gripping the tubular member; and

means for pulling an expansion device through an end of the tubular member.

431. The system of claim 430, wherein means for gripping the tubular member comprises:

means for permitting axial displacement of the tubular member in a first direction; and

means for not permitting axial displacement of the tubular member in a second direction.

432. The system of claim 430, wherein means for pulling the expansion device through the end of the tubular member comprises:

means for pulling the expansion device through the end of the tubular member using an actuator.

433. The system of claim 416, wherein means for radially expanding and plastically deforming a portion of the tubular member above the bell section comprises:

means for lowering an expansion device out of an end of the tubular member; and

means for pulling the expansion device through the end of the tubular member.

434. The system of claim 433, wherein means for lowering an expansion device out of an end of the tubular member comprises:

means for lowering the expansion device out of the end of the tubular member; and

means for adjusting the size of the expansion device.

435. The system of claim 434, wherein the adjustable expansion device is adjustable to a plurality of sizes.

436. The system of claim 434, wherein the expansion device comprises a plurality of adjustable expansion devices.

437. The system of claim 436, wherein at least one of the adjustable expansion devices is adjustable to a plurality of sizes.

438. The system of claim 433, wherein means for pulling the expansion device through the end of the tubular member comprises:

means for gripping the tubular member; and

means for pulling an expansion device through an end of the tubular member.

439. The system of claim 438, wherein means for gripping the tubular member comprises:

means for permitting axial displacement of the tubular member in a first direction; and

means for not permitting axial displacement of the tubular member in a second direction.

440. The system of claim 438, wherein means for pulling the expansion device through the end of the tubular member comprises:

means for pulling the expansion device through the end of the tubular member using an actuator.

441. The system of claim 433, wherein means for pulling the expansion device through the end of the tubular member comprises:

means for pulling the expansion device through the end of the tubular member using fluid pressure.

442. The system of claim 441, wherein means for pulling the expansion device through the end of the tubular member using fluid pressure comprises:

means for pressurizing an annulus within the tubular member above the expansion device.

443. The system of claim 416, wherein means for radially expanding and plastically deforming a portion of the tubular member above the bell section comprises:

means for fluidicly sealing an end of the tubular member; and

means for pulling the expansion device through the tubular member.

444. The system of claim 443, wherein the expansion device is adjustable.

445. The system of claim 444, wherein the expansion device is adjustable to a plurality of sizes.

446. The system of claim 443, wherein the expansion device comprises a plurality of adjustable expansion devices.

447. The system of claim 446, wherein at least one of the adjustable expansion devices is adjustable to a plurality of sizes.

448. The system of claim 443, wherein means for pulling the expansion device through the end of the tubular member comprises:

means for gripping the tubular member; and

means for pulling an expansion device through an end of the tubular member.

449. The system of claim 448, wherein means for gripping the tubular member comprises:

means for permitting axial displacement of the tubular member in a first direction; and

means for not permitting axial displacement of the tubular member in a second direction.

450. The system of claim 448, wherein means for pulling the expansion device through the end of the tubular member comprises:

means for pulling the expansion device through the end of the tubular member using an actuator.

451. The system of claim 443, wherein means for pulling the expansion device through the end of the tubular member comprises:

means for pulling the expansion device through the end of the tubular member using fluid pressure.

452. The system of claim 451, wherein means for pulling the expansion device through the end of the tubular member using fluid pressure comprises:

means for pressurizing an annulus within the tubular member above the expansion device.

453. The system of claim 416, wherein means for radially expanding and plastically deforming a portion of the tubular member above the bell section comprises:

means for overlapping the portion of the tubular member above the bell section with an end of a preexisting tubular member; and

means for pulling an expansion device through the overlapping portions of the tubular member and the preexisting tubular member.

454. The system of claim 453, wherein the expansion device is adjustable.

455. The system of claim 454, wherein the expansion device is adjustable to a plurality of sizes.

456. The system of claim 453, wherein the expansion device comprises a plurality of adjustable expansion devices.

457. The system of claim 456, wherein at least one of the adjustable expansion devices is adjustable to a plurality of sizes.

458. The system of claim 453, wherein means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member comprises:

means for gripping the tubular member; and

means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member.

459. The system of claim 458, wherein means for gripping the tubular member comprises:

means for permitting axial displacement of the tubular member in a first direction; and

means for not permitting axial displacement of the tubular member in a second direction.

460. The system of claim 458, wherein means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member comprises:

means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using an actuator.

461. The system of claim 453, wherein means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member comprises:

means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using fluid pressure.

462. The system of claim 461, wherein means for pulling the expansion device through the overlapping portions of the tubular member and the preexisting tubular member using fluid pressure comprises:

means for pressurizing an annulus within the tubular member above the expansion device.

463. The system of claim 453, further comprising:
means for cutting an end of the portion of the tubular member that overlaps with the preexisting tubular member.

464. The system of claim 463, further comprising:
means for removing the cut off end of the expandable tubular member from the preexisting structure.

465. The system of claim 416, further comprising:
means for injecting a hardenable fluidic sealing material into an annulus between the expandable tubular member and the preexisting structure.

466. The system of claim 416, further comprising:
means for cutting off an end of the expandable tubular member.

467. The system of claim 466, further comprising:
means for removing the cut off end of the expandable tubular member from the preexisting structure.

468. A system of radially expanding and plastically deforming a tubular member, comprising:
a support member; and
means for applying internal pressure to the inside surface of the tubular member at a plurality of discrete location separated from one another coupled to the support member.

469. A method of cutting a tubular member, comprising:
positioning a plurality of cutting elements within the tubular member; and
bringing the cutting elements into engagement with the tubular member.

470. The method of claim 469, wherein the cutting elements comprise:
a first group of cutting elements; and
a second group of cutting elements;

wherein the first group of cutting elements are interleaved with the second group of cutting elements.

471. The method of claim 469, wherein bringing the cutting elements into engagement with the tubular member comprises:

bringing the cutting elements into axial alignment.

472. The method of claim 471, wherein bringing the cutting elements into engagement with the tubular member further comprises:

pivoting the cutting elements.

473. The method of claim 471, wherein bringing the cutting elements into engagement with the tubular member further comprises:

translating the cutting elements.

474. The method of claim 471, wherein bringing the cutting elements into engagement with the tubular member further comprises:

pivoting the cutting elements; and

translating the cutting elements.

475. The method of claim 469, wherein bringing the cutting elements into engagement with the tubular member comprises:

rotating the cutting elements about a common axis.

476. The method of claim 469, wherein bringing the cutting elements into engagement with the tubular member comprises:

pivoting the cutting elements about corresponding axes;

translating the cutting elements; and

rotating the cutting elements about a common axis.

477. The method of claim 469, further comprising:

preventing the cutting elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value.

478. The method of claim 477, wherein preventing the cutting elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value comprises:

sensing the inside diameter of the tubular member.

479. A method of gripping a tubular member, comprising:

positioning a plurality of gripping elements within the tubular member; and

bringing the gripping elements into engagement with the tubular member.

480. The method of claim 479, wherein bringing the gripping elements into engagement with the tubular member comprises:

displacing the gripping elements in an axial direction; and

displacing the gripping elements in a radial direction.

481. The method of claim 479, further comprising:

biasing the gripping elements against engagement with the tubular member.

482. A method of operating an actuator, comprising:

pressurizing a plurality of pressure chamber.

483. The method of claim 482, further comprising:

transmitting torsional loads.

484. A method of injecting a hardenable fluidic sealing material into an annulus between a tubular member and a preexisting structure, comprising:

positioning the tubular member into the preexisting structure;

sealing off an end of the tubular member;

operating a valve within the end of the tubular member; and

injecting a hardenable fluidic sealing material through the valve into the annulus between the tubular member and the preexisting structure.

485. A system for cutting a tubular member, comprising:

means for positioning a plurality of cutting elements within the tubular member; and

means for bringing the cutting elements into engagement with the tubular member.

486. The system of claim 485, wherein the cutting elements comprise:

a first group of cutting elements; and

a second group of cutting elements;

wherein the first group of cutting elements are interleaved with the second group of cutting elements.

487. The system of claim 485, wherein means for bringing the cutting elements into engagement with the tubular member comprises:

means for bringing the cutting elements into axial alignment.

488. The system of claim 485, wherein means for bringing the cutting elements into engagement with the tubular member further comprises:

means for pivoting the cutting elements.

489. The system of claim 485, wherein means for bringing the cutting elements into engagement with the tubular member further comprises:

means for translating the cutting elements.

490. The system of claim 485, wherein means for bringing the cutting elements into engagement with the tubular member further comprises:

means for pivoting the cutting elements; and

means for translating the cutting elements.

491. The method of claim 485, wherein means for bringing the cutting elements into engagement with the tubular member comprises:

means for rotating the cutting elements about a common axis.

492. The system of claim 485, wherein means for bringing the cutting elements into engagement with the tubular member comprises:

means for pivoting the cutting elements about corresponding axes;

means for translating the cutting elements; and

means for rotating the cutting elements about a common axis.

493. The system of claim 485, further comprising:

means for preventing the cutting elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value.

494. The system of claim 493, wherein means for preventing the cutting elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value comprises:

means for sensing the inside diameter of the tubular member.

495. A system for gripping a tubular member, comprising:

means for positioning a plurality of gripping elements within the tubular member; and

means for bringing the gripping elements into engagement with the tubular member.

496. The system of claim 495, wherein means for bringing the gripping elements into engagement with the tubular member comprises:

means for displacing the gripping elements in an axial direction; and

means for displacing the gripping elements in a radial direction.

497. The system of claim 495, further comprising:

means for biasing the gripping elements against engagement with the tubular member.

498. An actuator system, comprising:

a support member; and

means for pressurizing a plurality of pressure chambers coupled to the support member.

499. The system of claim 498, further comprising:

means for transmitting torsional loads.

500. A system for injecting a hardenable fluidic sealing material into an annulus between a tubular member and a preexisting structure, comprising:

means for positioning the tubular member into the preexisting structure;

means for sealing off an end of the tubular member;

means for operating a valve within the end of the tubular member; and

means for injecting a hardenable fluidic sealing material through the valve into the annulus between the tubular member and the preexisting structure.

501. A method of engaging a tubular member, comprising:

positioning a plurality of elements within the tubular member; and

bringing the elements into engagement with the tubular member.

502. The method of claim 501, wherein the elements comprise:
a first group of elements; and
a second group of elements;
wherein the first group of elements are interleaved with the second group of elements.

503. The method of claim 501, wherein bringing the elements into engagement with the tubular member comprises:
bringing the elements into axial alignment.

504. The method of claim 501, wherein bringing the elements into engagement with the tubular member further comprises:
pivoting the elements.

505. The method of claim 501, wherein bringing the elements into engagement with the tubular member further comprises:
translating the elements.

506. The method of claim 501, wherein bringing the elements into engagement with the tubular member further comprises:
pivoting the elements; and
translating the elements.

507. The method of claim 501, wherein bringing the elements into engagement with the tubular member comprises:
rotating the elements about a common axis.

508. The method of claim 501, wherein bringing the elements into engagement with the tubular member comprises:
pivoting the elements about corresponding axes;
translating the elements; and
rotating the elements about a common axis.

509. The method of claim 501, further comprising:
preventing the elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value.

510. The method of claim 509, wherein preventing the elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value comprises:

sensing the inside diameter of the tubular member.

511. A system for engaging a tubular member, comprising:

means for positioning a plurality of elements within the tubular member; and

means for bringing the elements into engagement with the tubular member.

512. The system of claim 511, wherein the elements comprise:

a first group of elements; and

a second group of elements;

wherein the first group of elements are interleaved with the second group of elements.

513. The system of claim 511, wherein means for bringing the elements into engagement with the tubular member comprises:

means for bringing the elements into axial alignment.

514. The system of claim 511, wherein means for bringing the elements into engagement with the tubular member further comprises:

means for pivoting the elements.

515. The system of claim 511, wherein means for bringing the elements into engagement with the tubular member further comprises:

means for translating the elements.

516. The system of claim 511, wherein means for bringing the elements into engagement with the tubular member further comprises:

means for pivoting the elements; and

means for translating the elements.

517. The system of claim 511, wherein means for bringing the elements into engagement with the tubular member comprises:

means for rotating the elements about a common axis.

518. The system of claim 511, wherein means for bringing the elements into engagement with the tubular member comprises:

means for pivoting the elements about corresponding axes;

means for translating the elements; and

means for rotating the elements about a common axis.

519. The system of claim 511, further comprising:

means for preventing the elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value.

520. The system of claim 519, wherein means for preventing the elements from coming into engagement with the tubular member if the inside diameter of the tubular member is less than a predetermined value comprises:

means for sensing the inside diameter of the tubular member.

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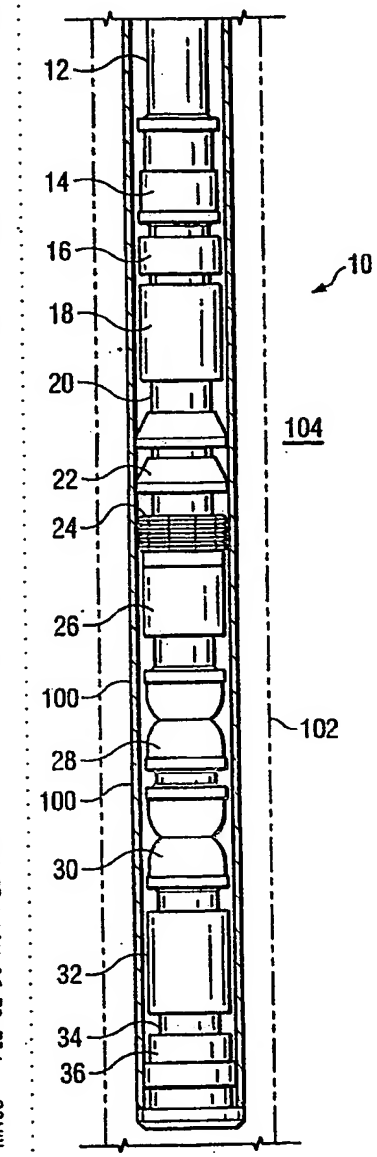

Fig. 1

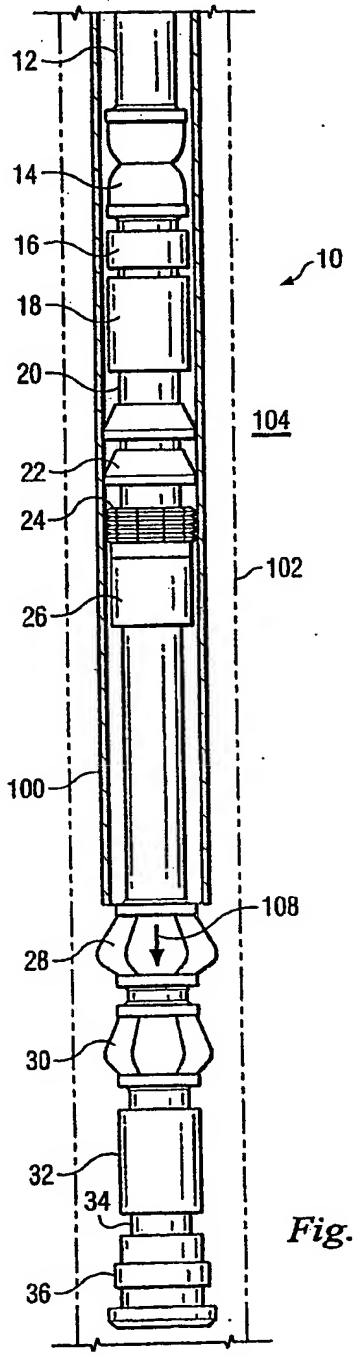

Fig. 2

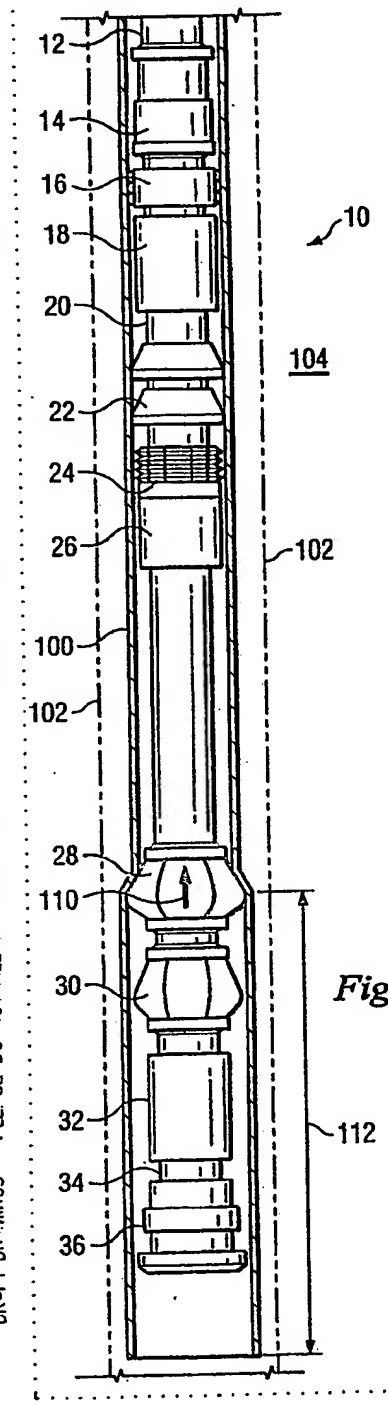

Fig. 3

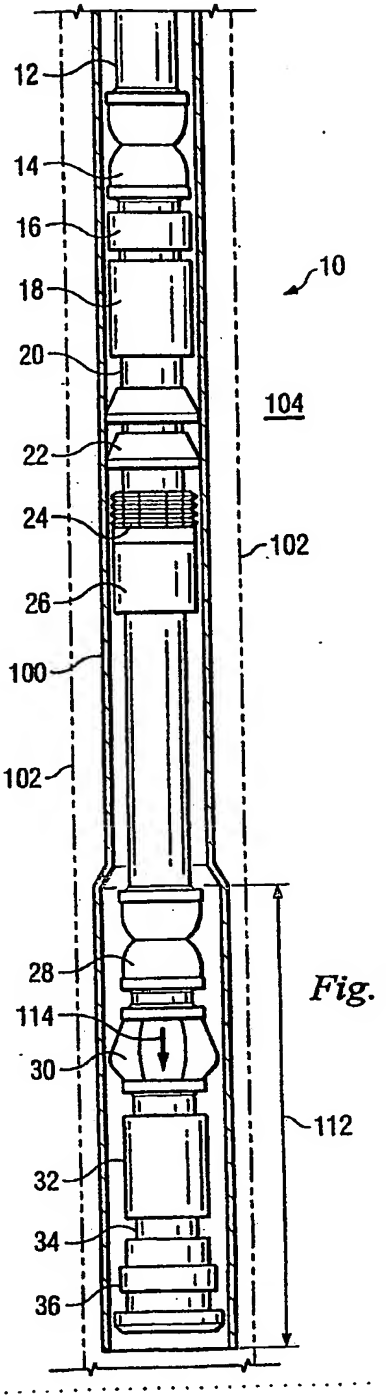

Fig. 4

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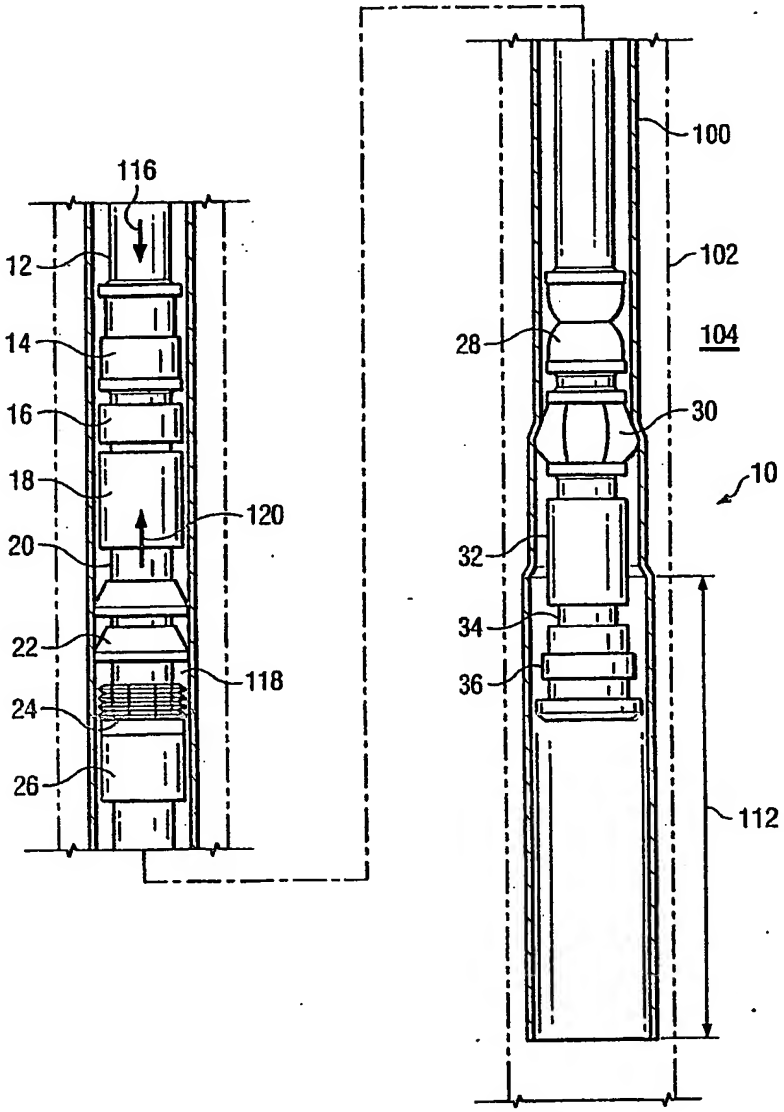

Fig. 5

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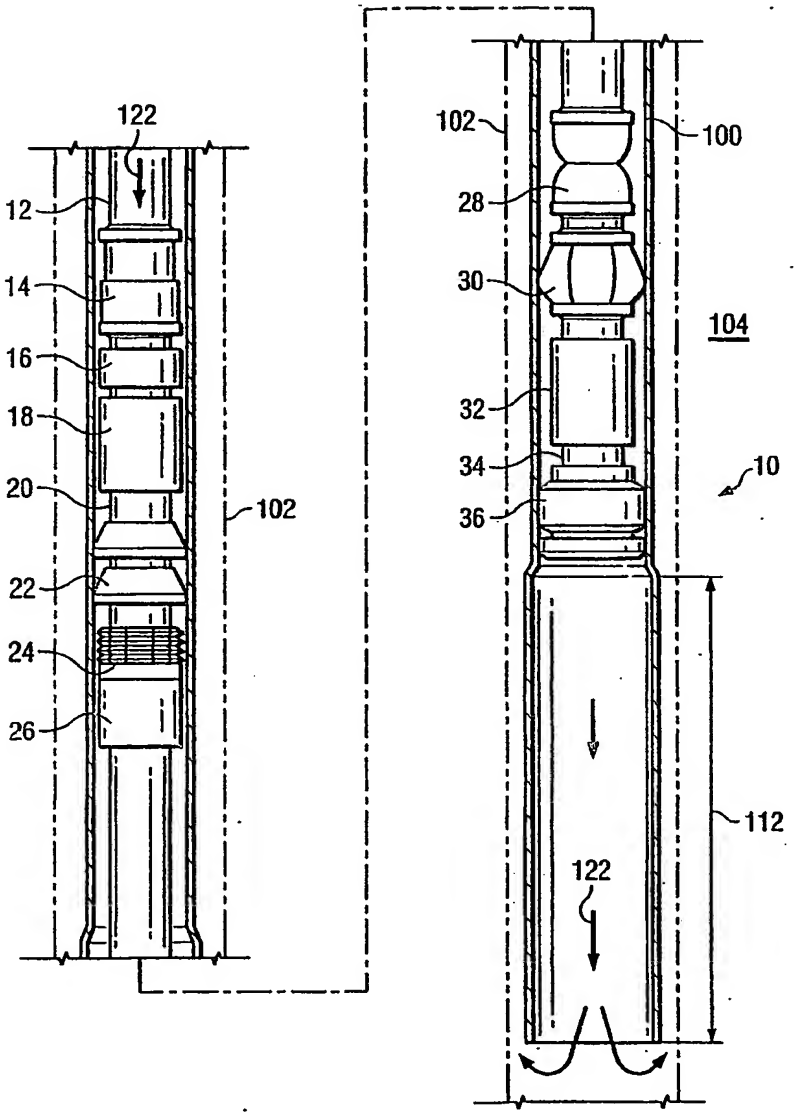

Fig. 6

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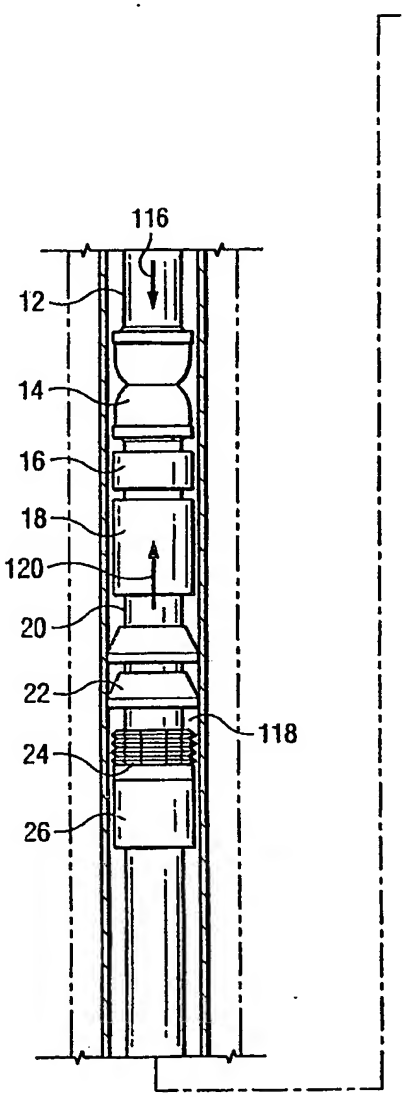

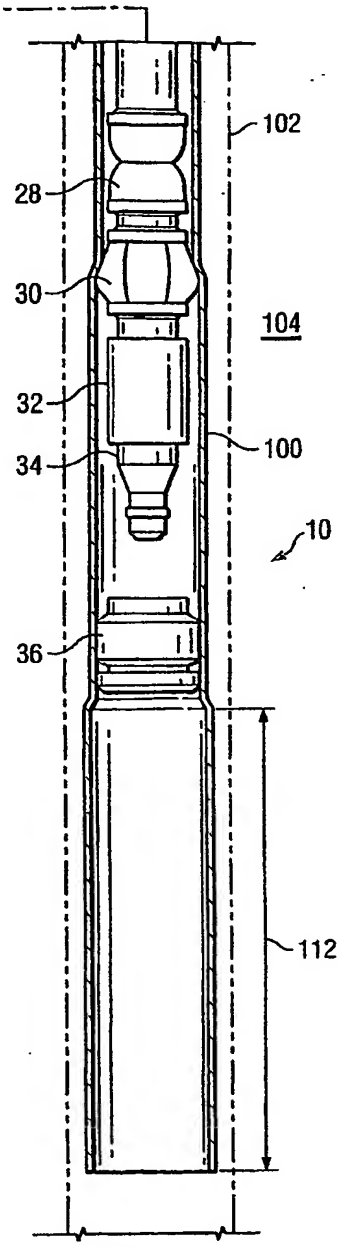

Fig. 7

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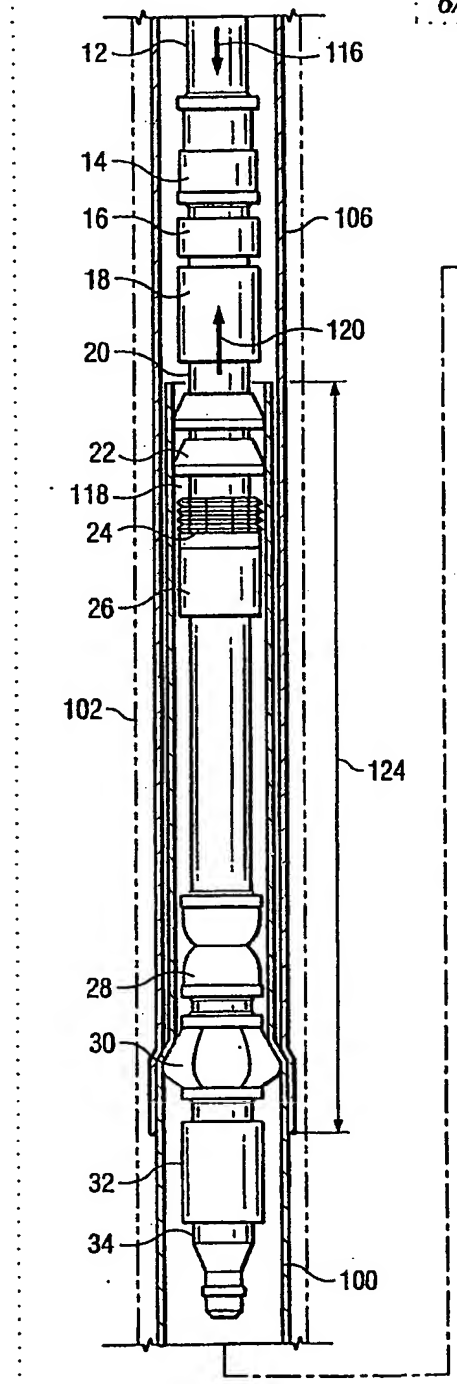

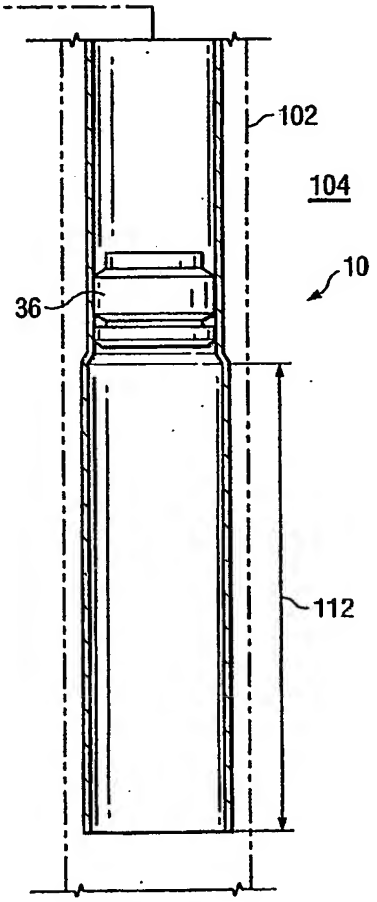

Fig. 8

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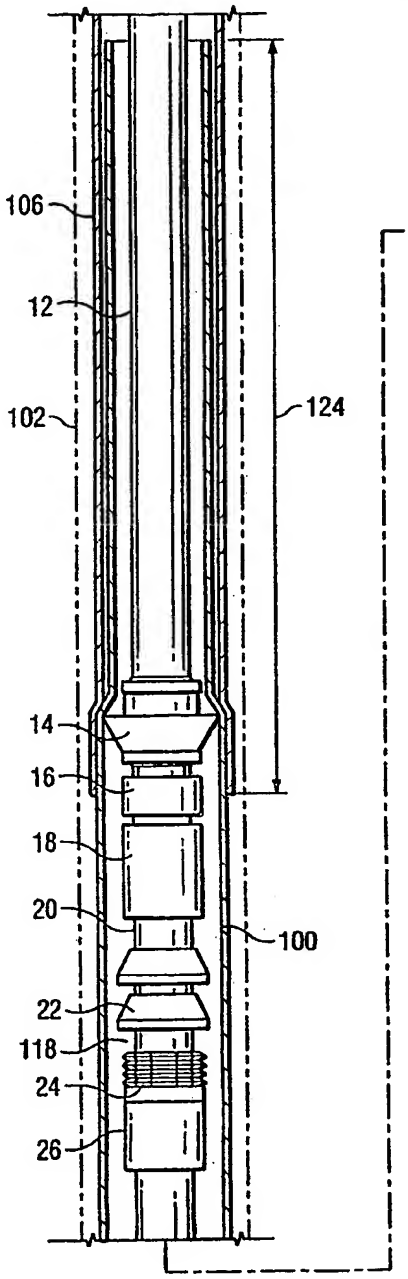

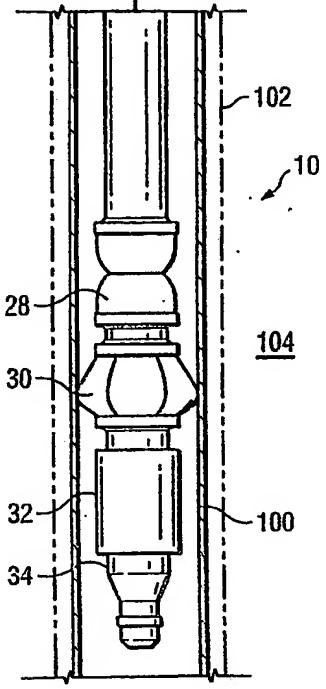

Fig. 9

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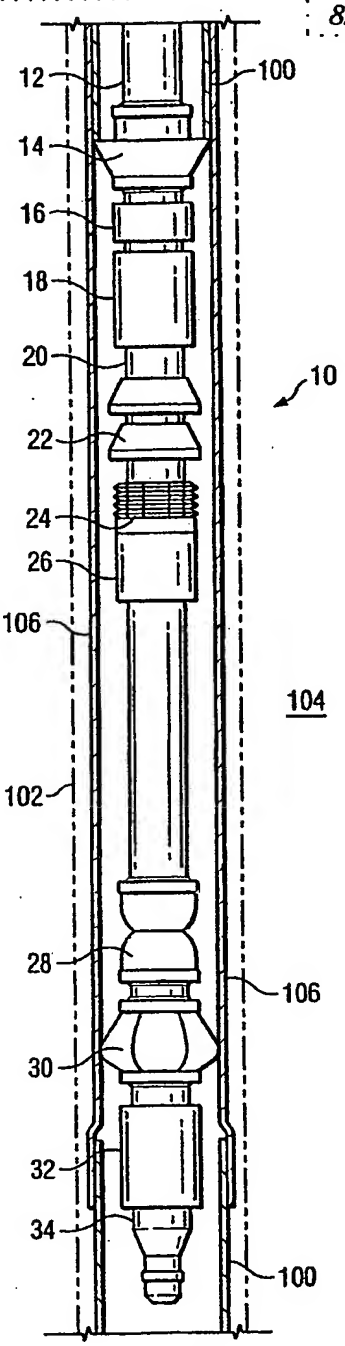

Fig. 10

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Fig. 11-1

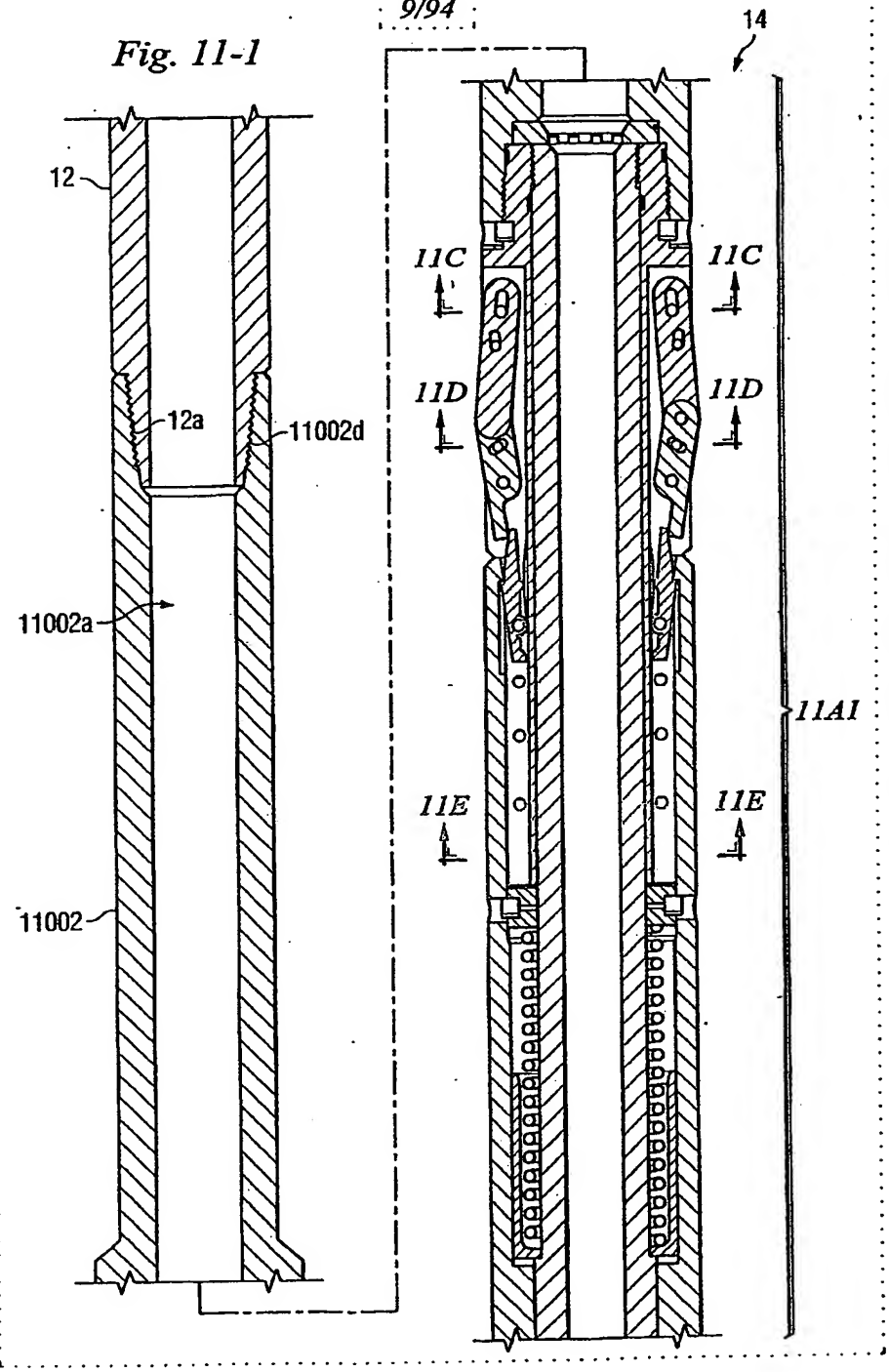

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Fig. 11-2

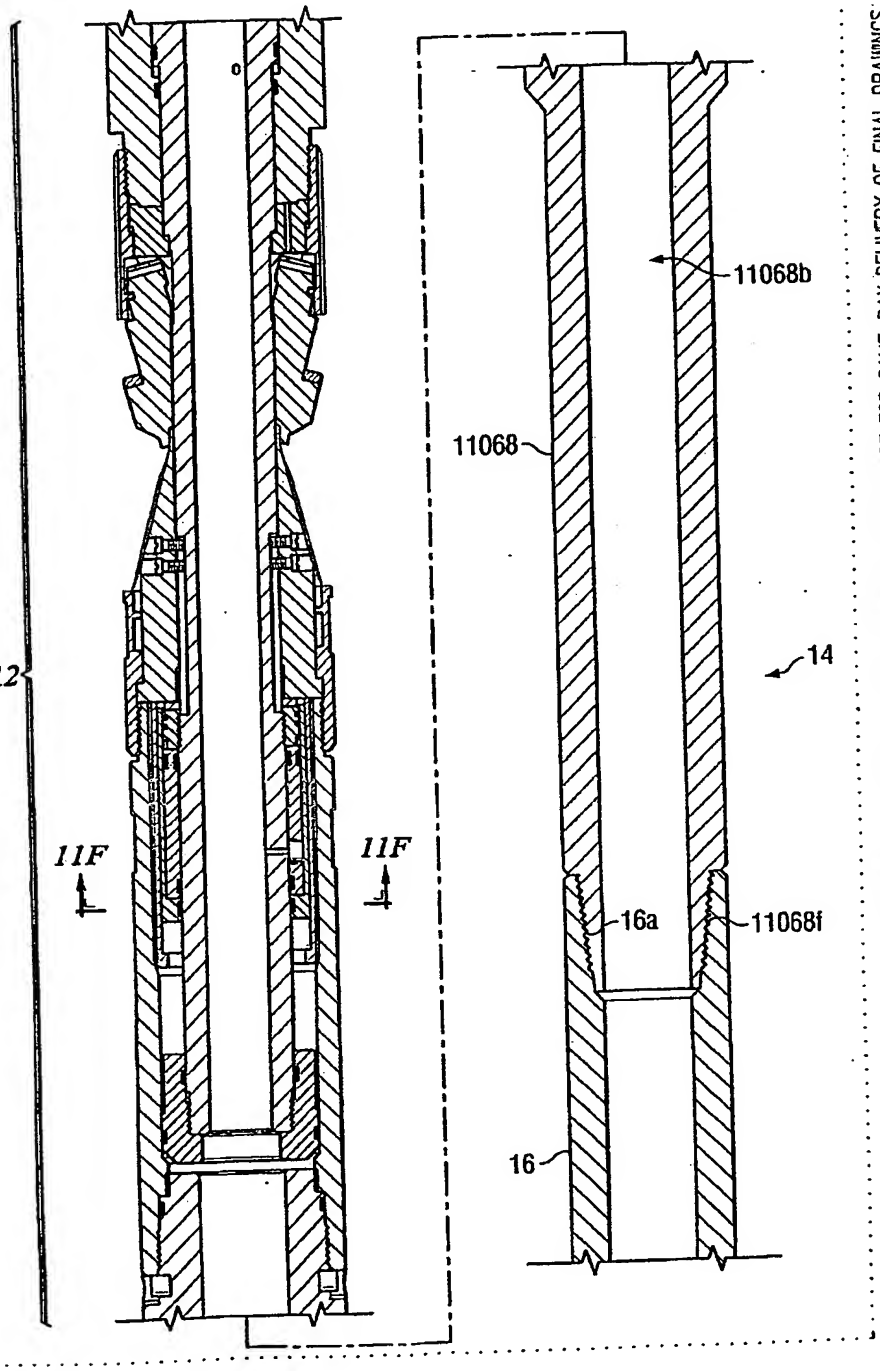

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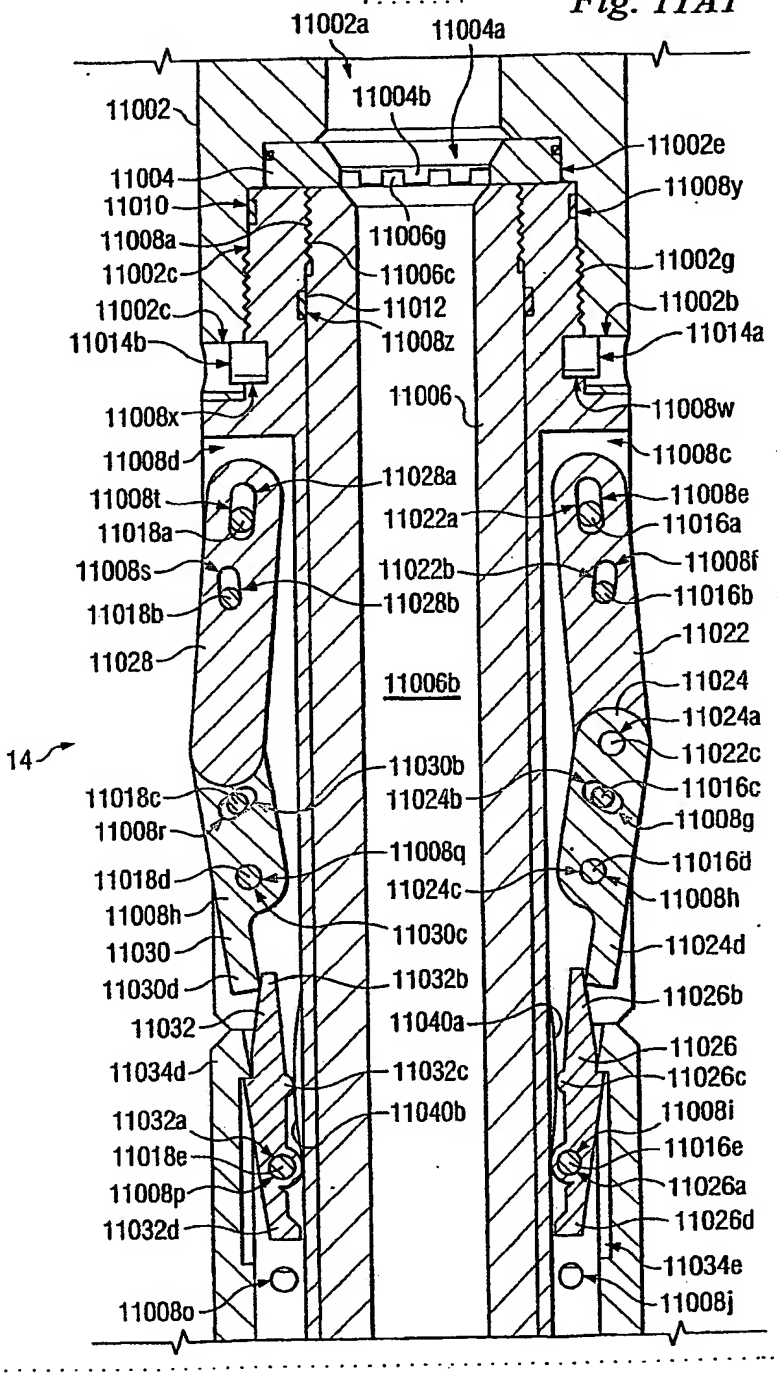
Fig. 11A1



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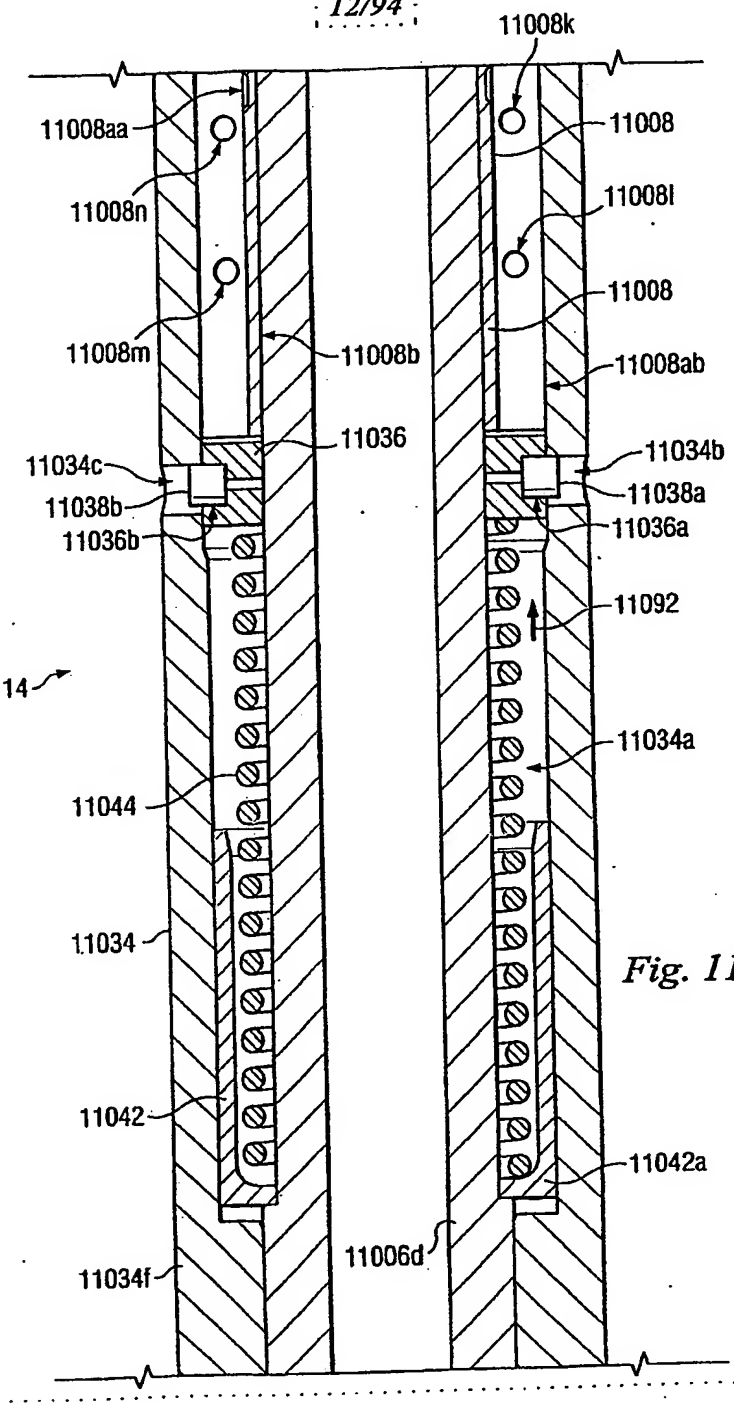

Fig. 11A2

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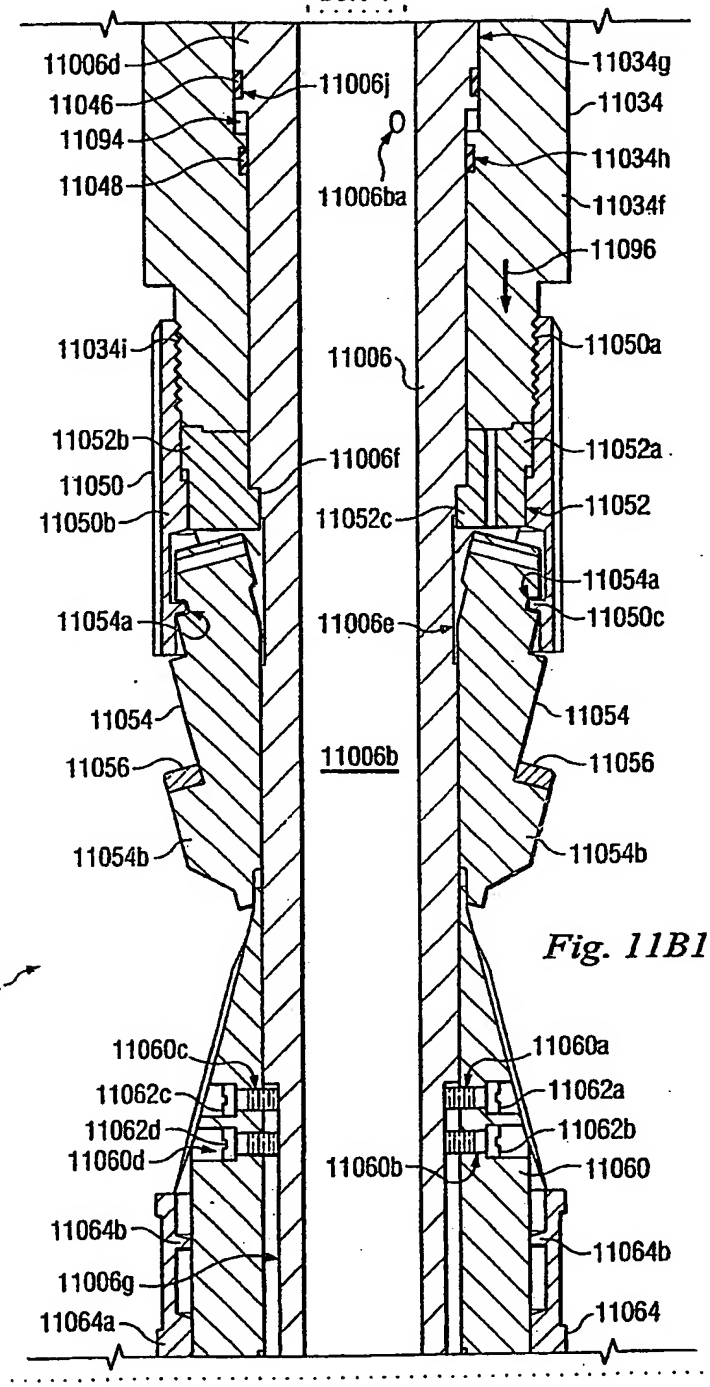

Fig. 11B1

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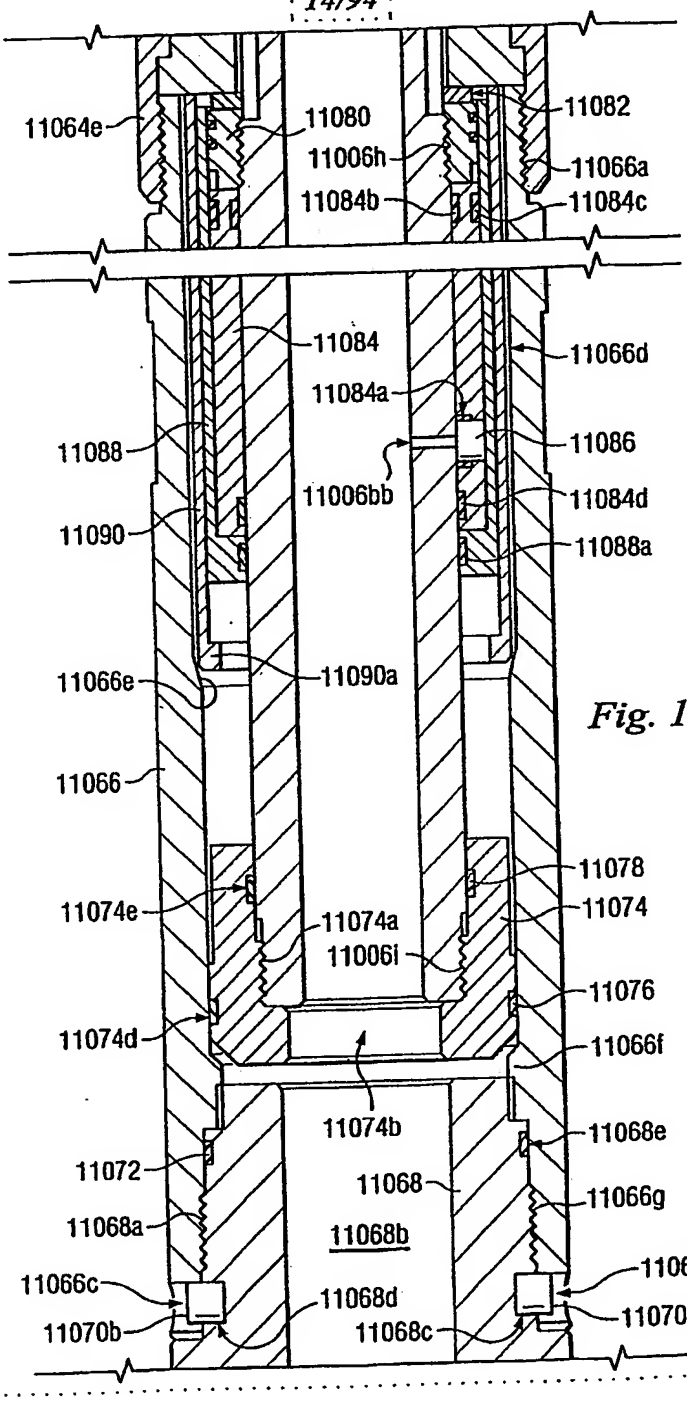

Fig. 11B2

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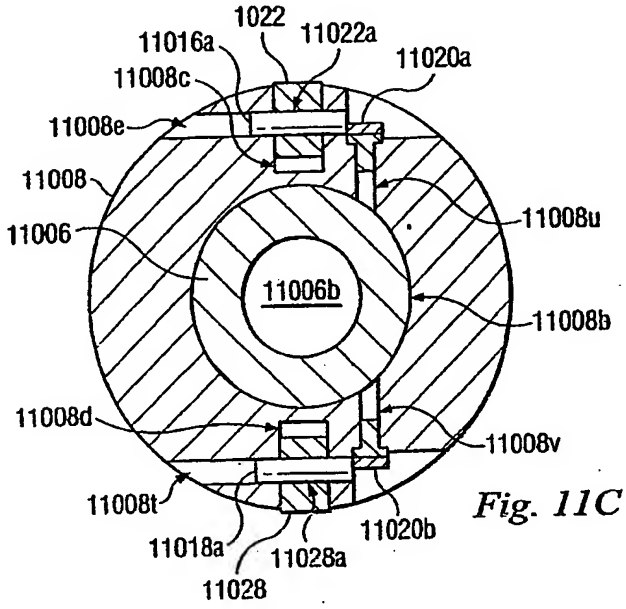

Fig. 11C

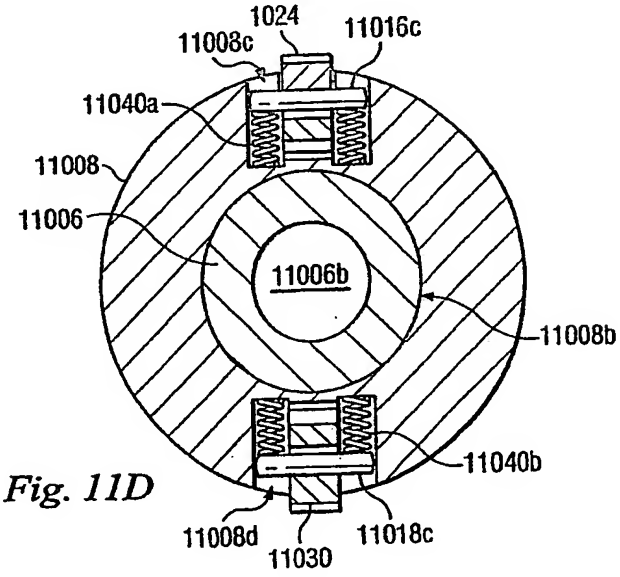

Fig. 11D

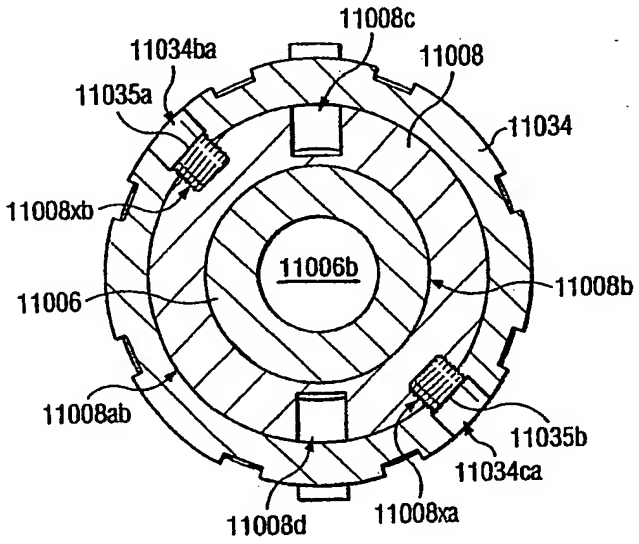

Fig. 11E

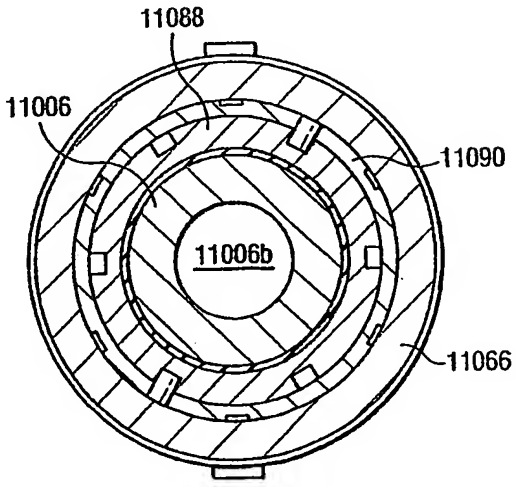

Fig. 11F

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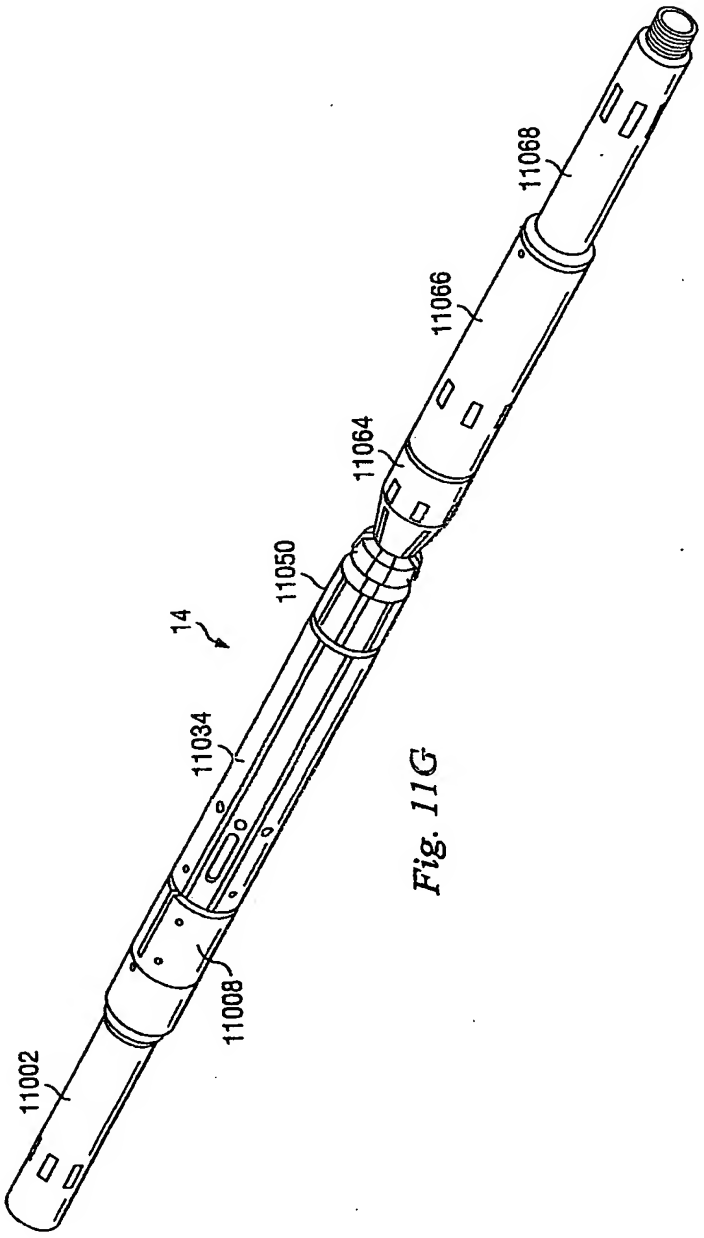

Fig. 11G

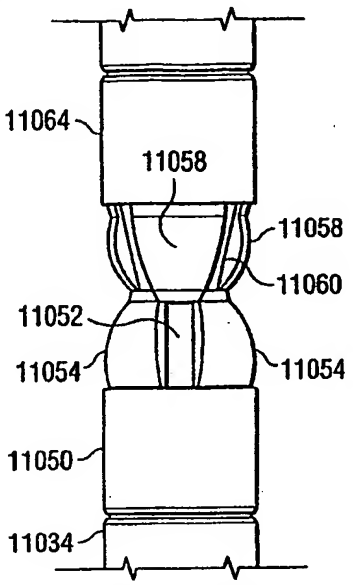

Fig. 11H

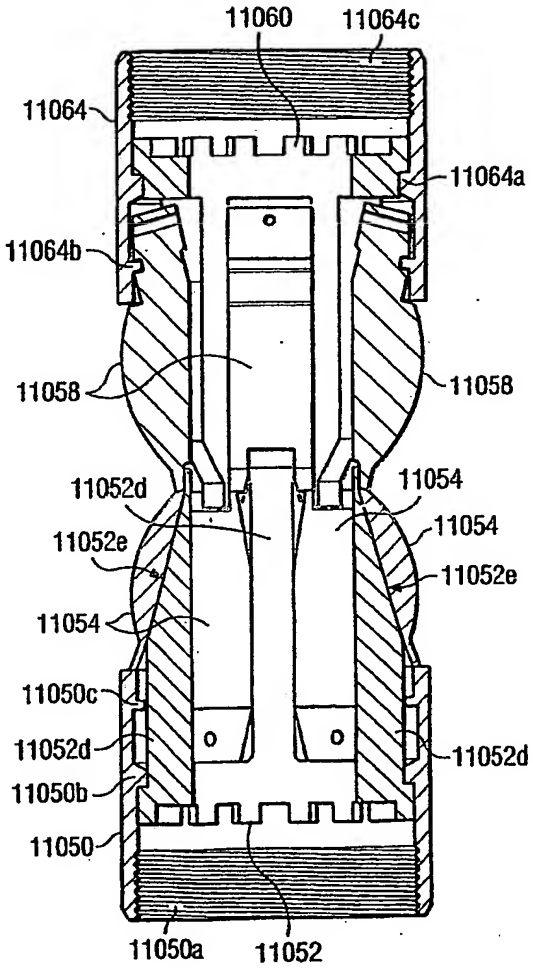

FIG. 11I

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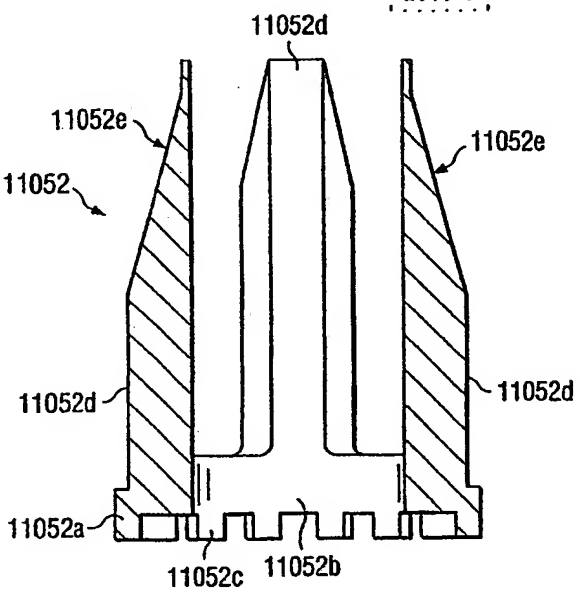

Fig. 11J

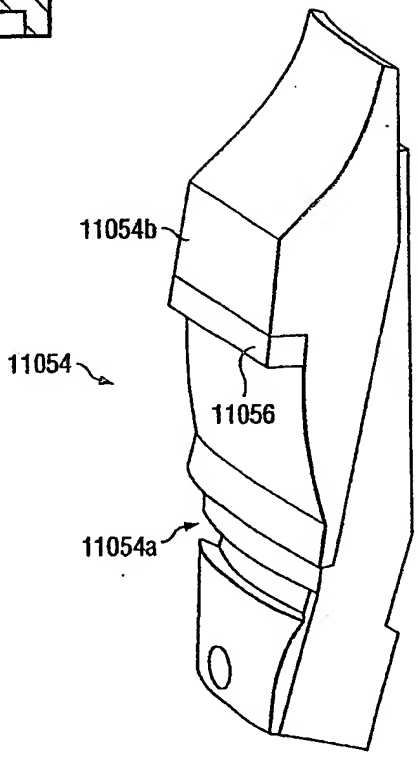

Fig. 11K

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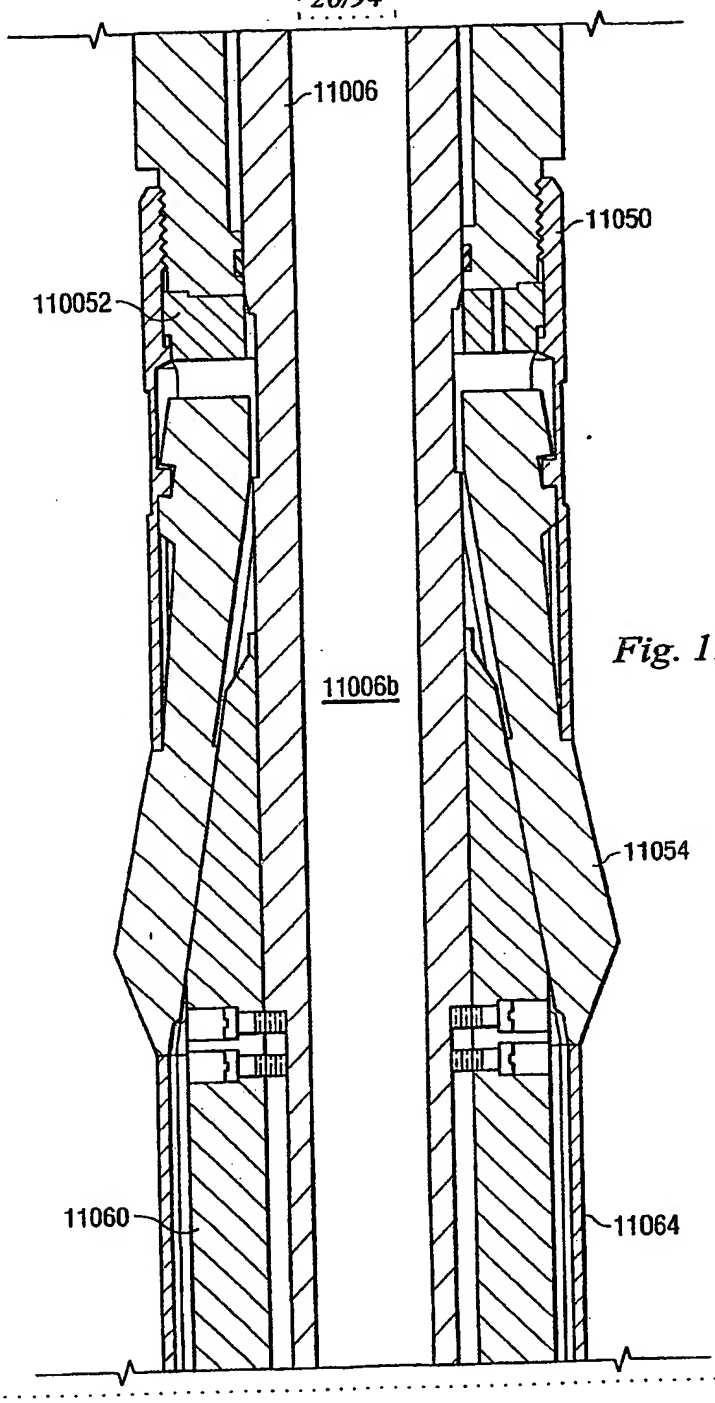

Fig. 11L

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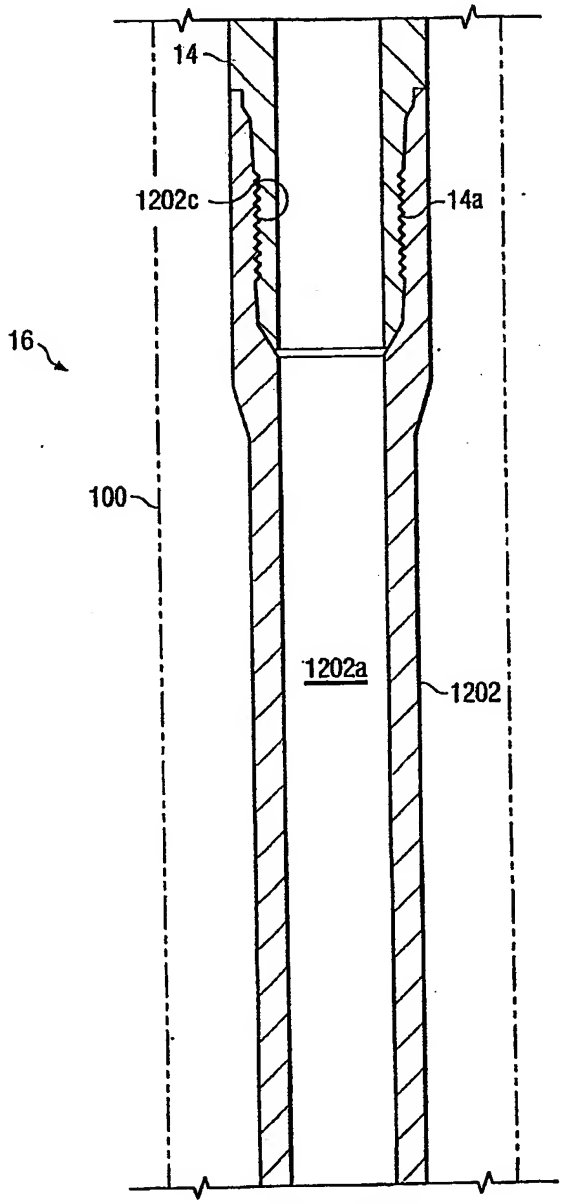

Fig. 12A1

25791.253

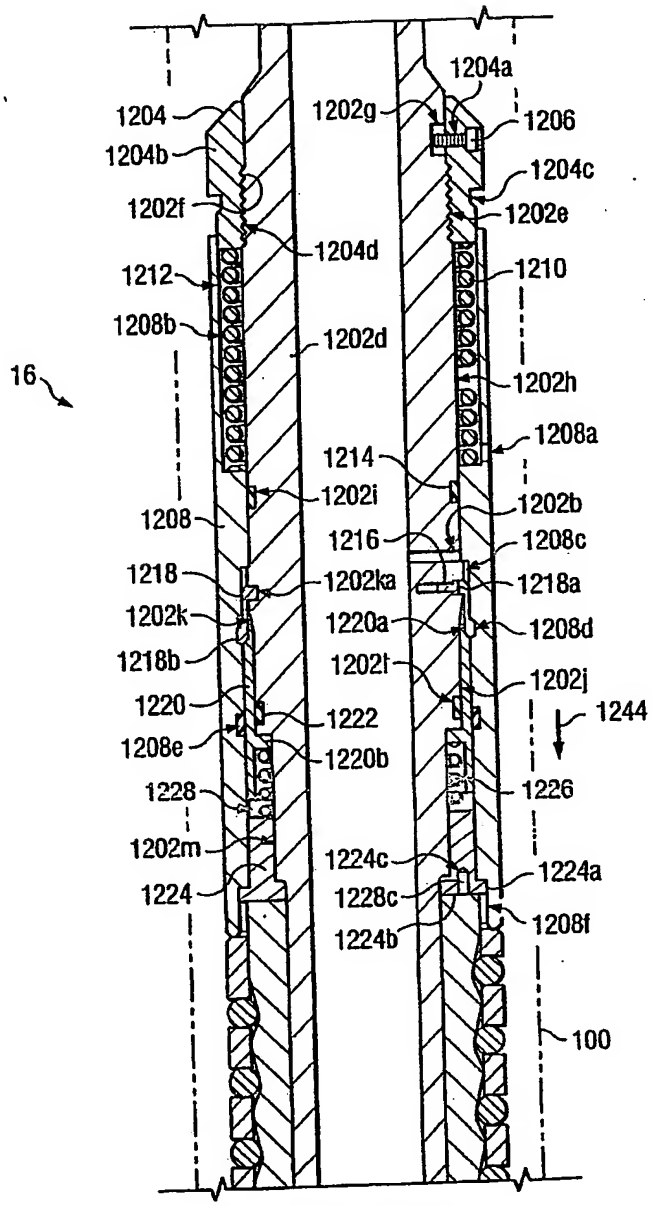

Fig. 12A2

25791.253

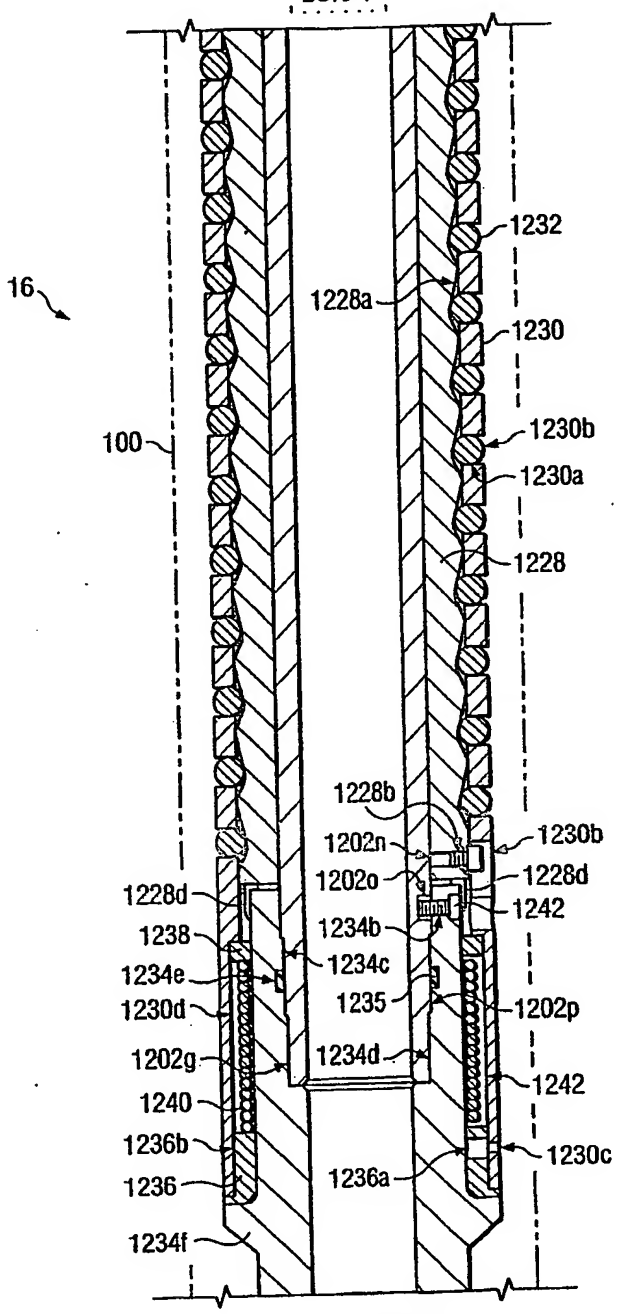

Fig. 12A3

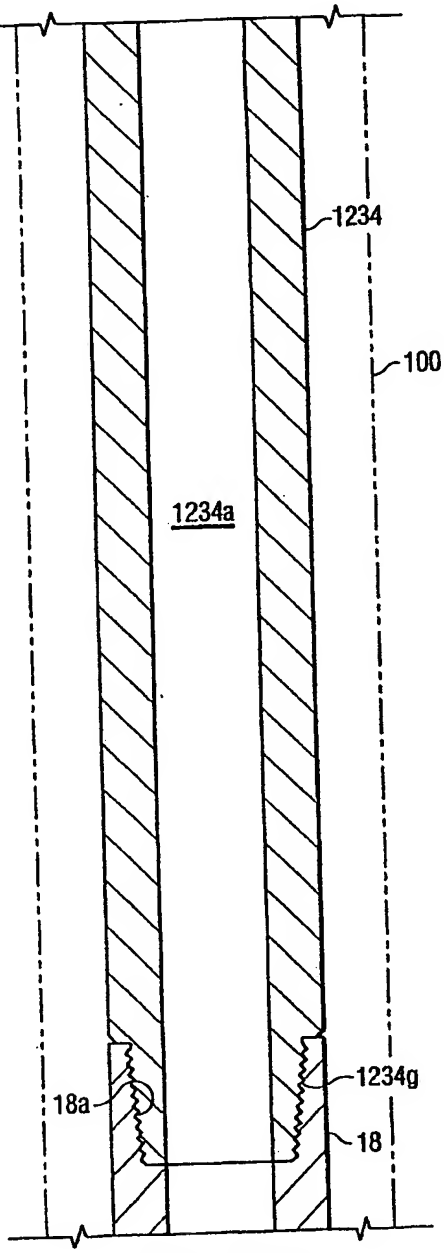

Fig. 12A4

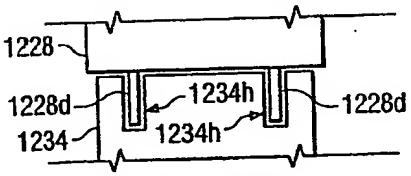

Fig. 12B

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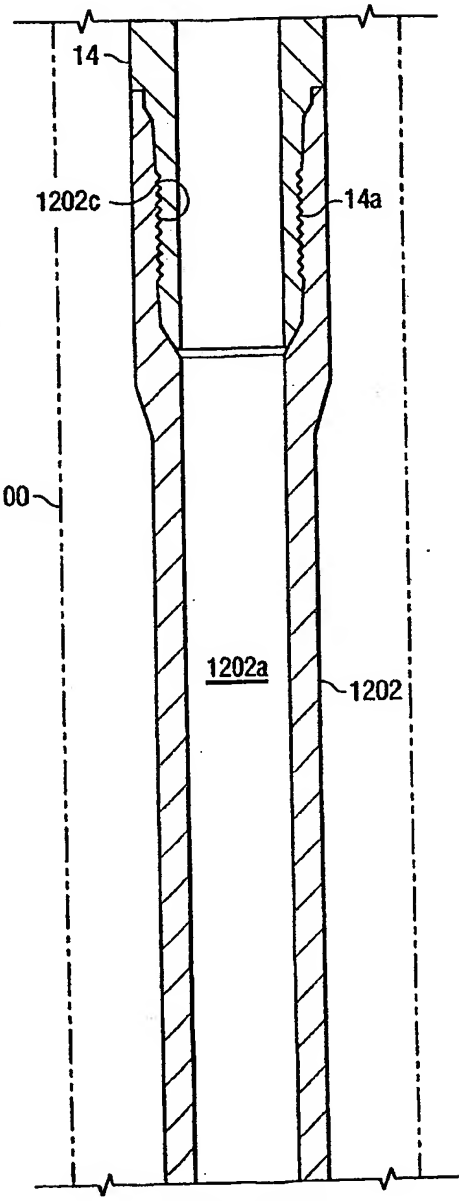

Fig. 12C1

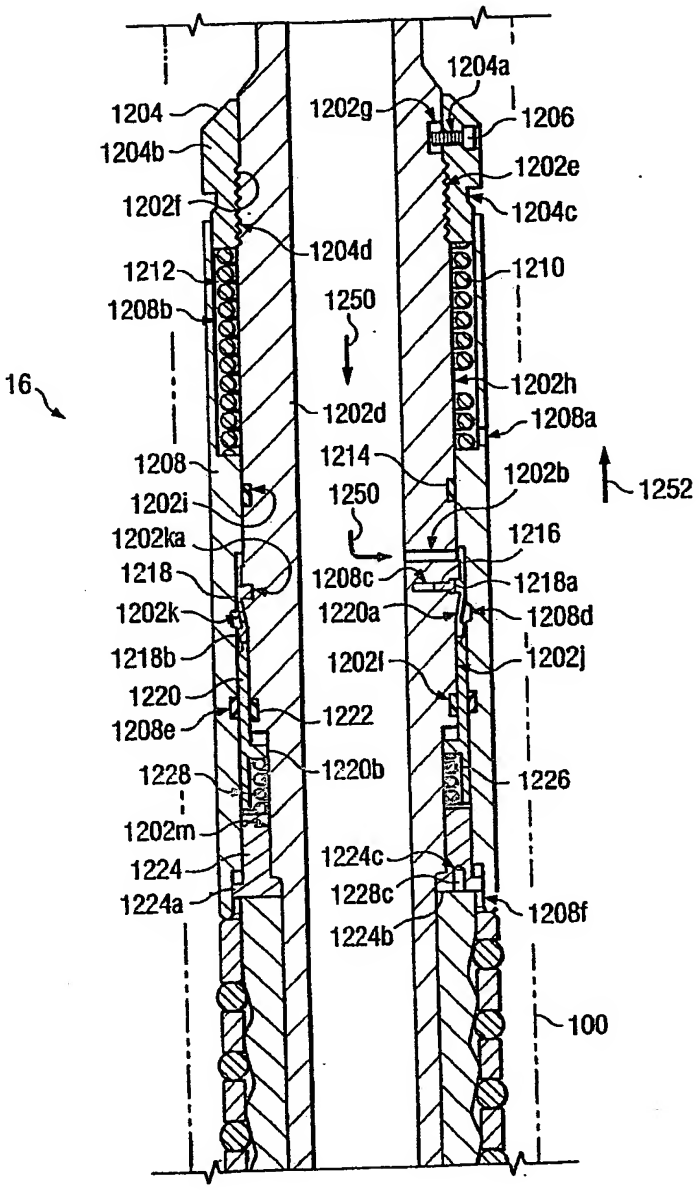

Fig. 12C2

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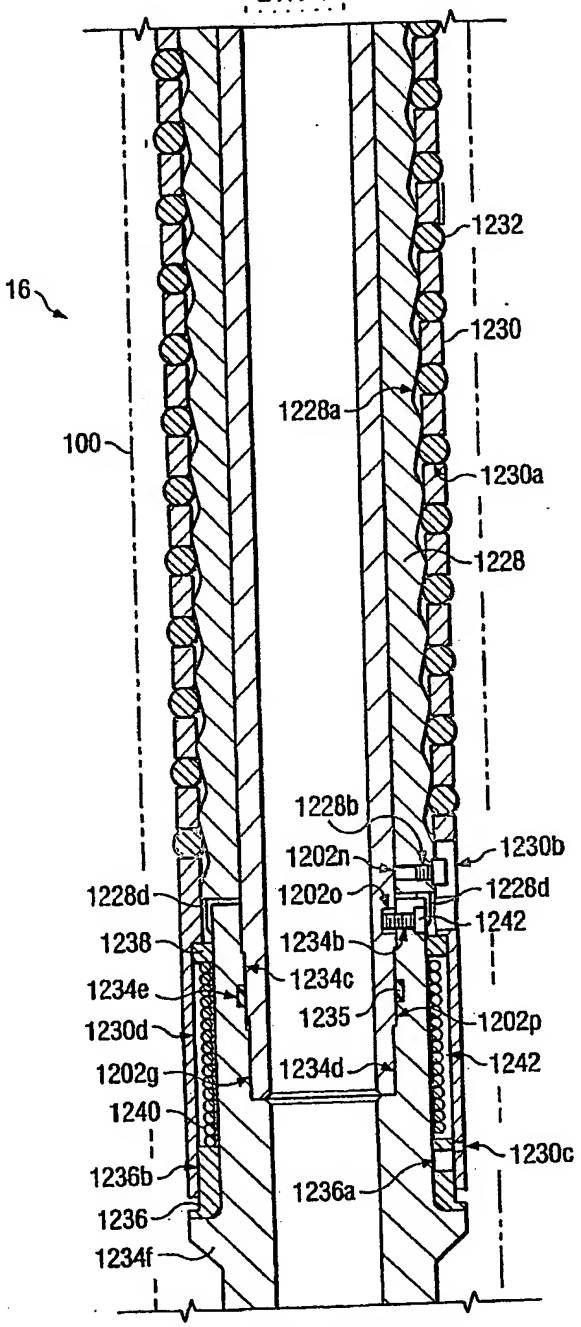

Fig. 12C3

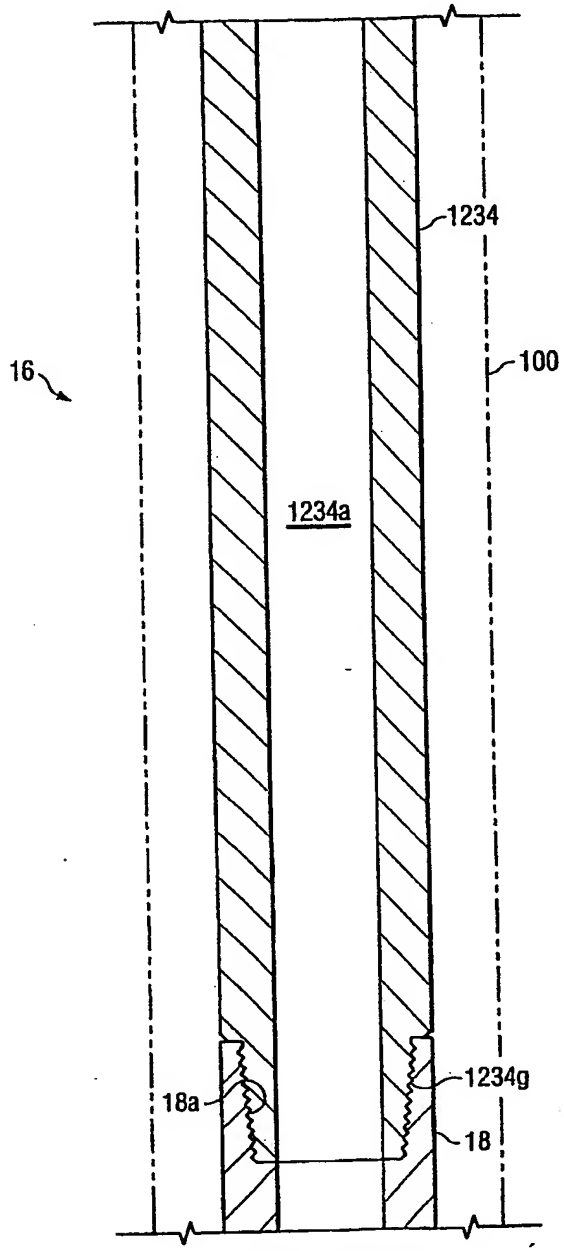

Fig. 12C4

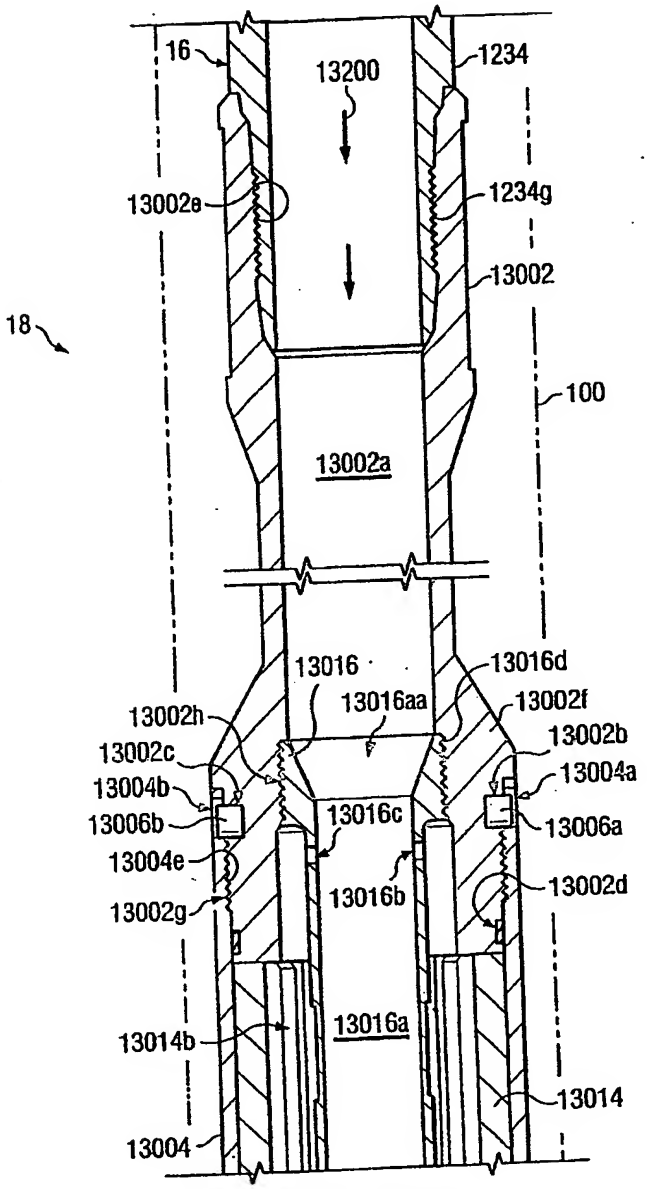

Fig. 13A1

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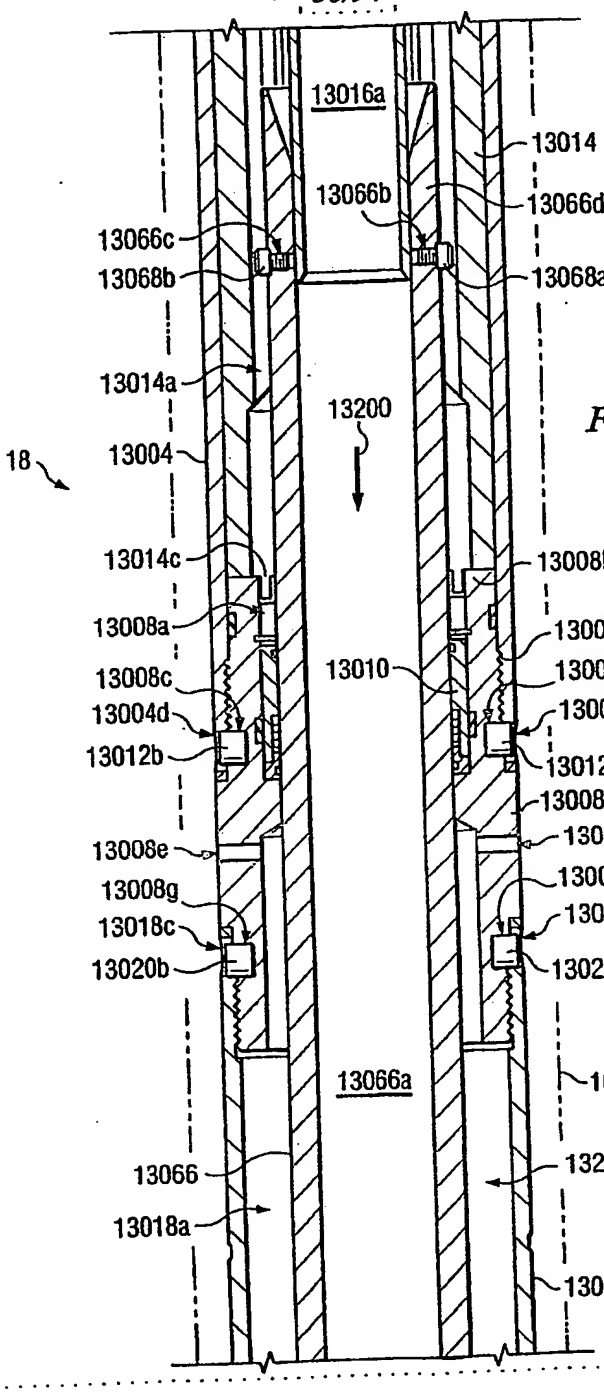

Fig. 13A2

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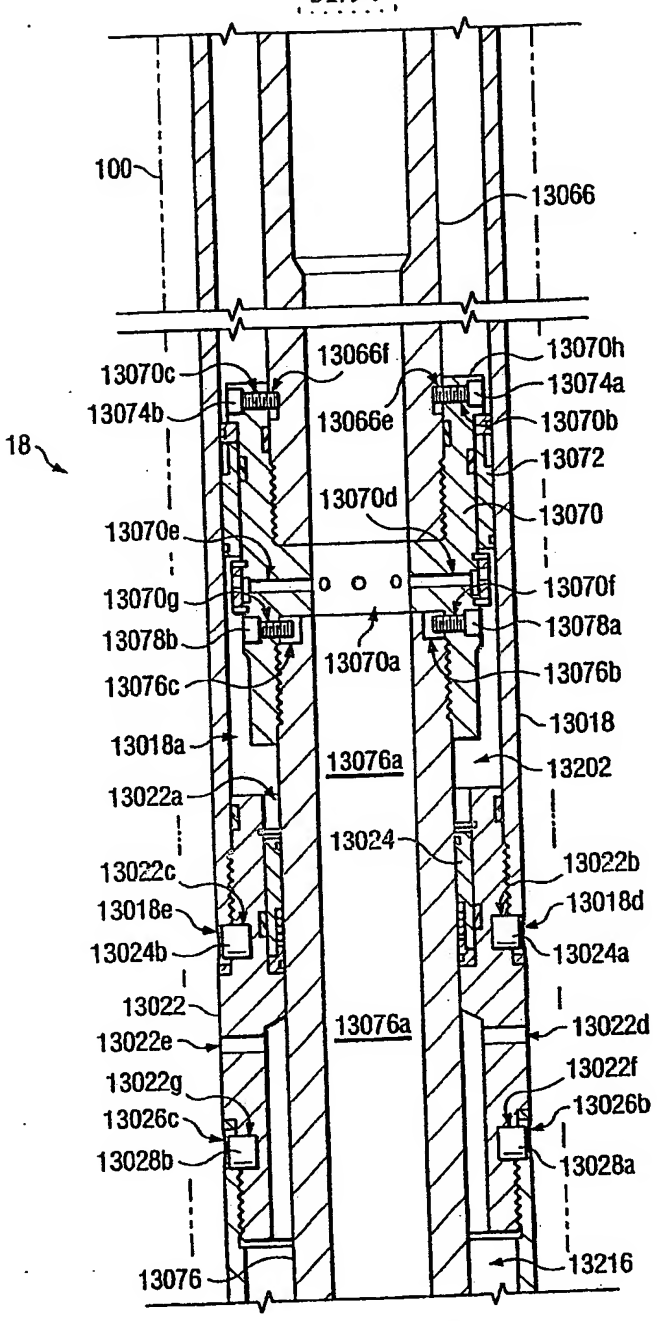

Fig. 13A3

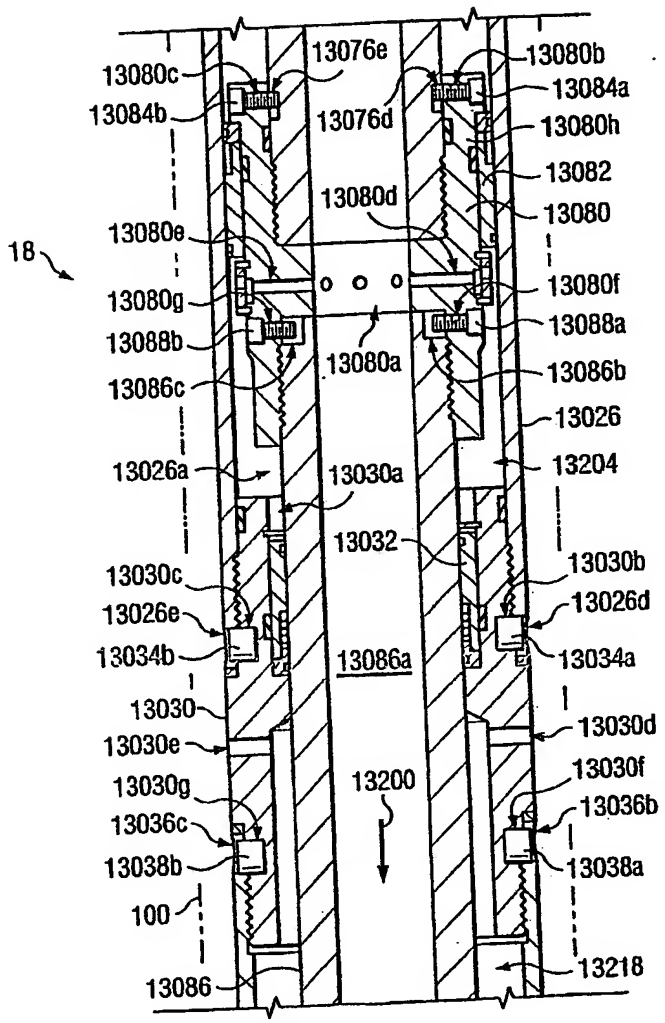

Fig. 13A4

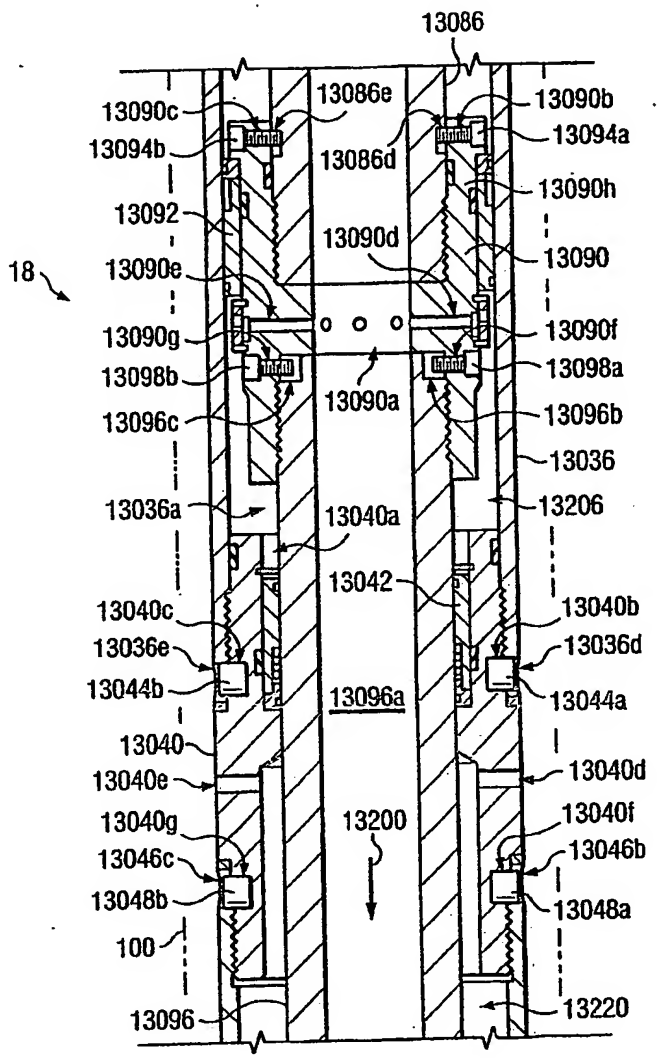
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Fig. 13A5

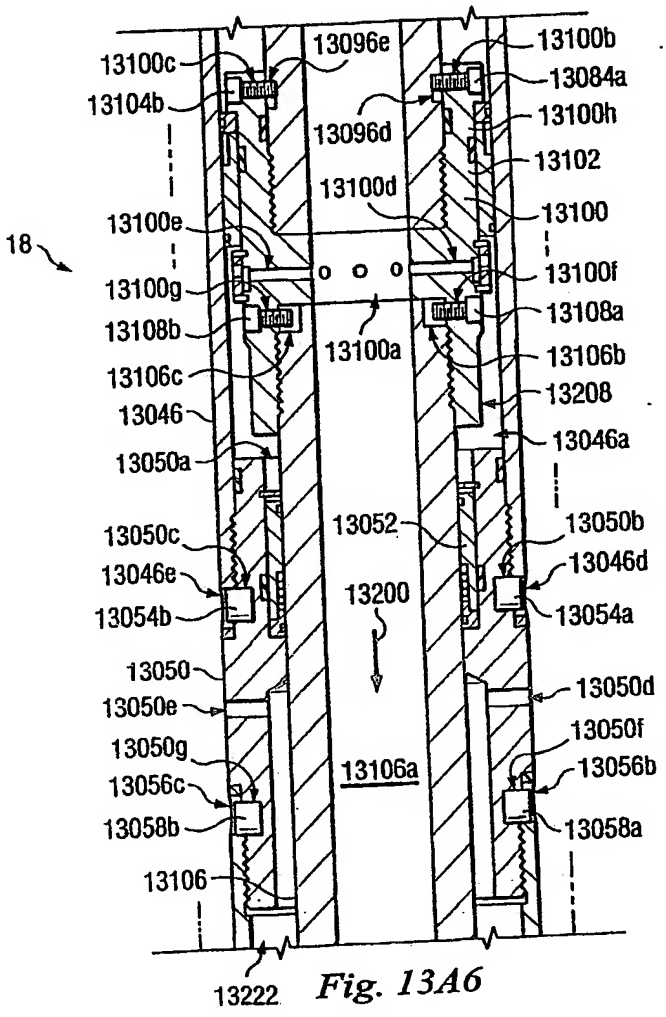

Fig. 13A6

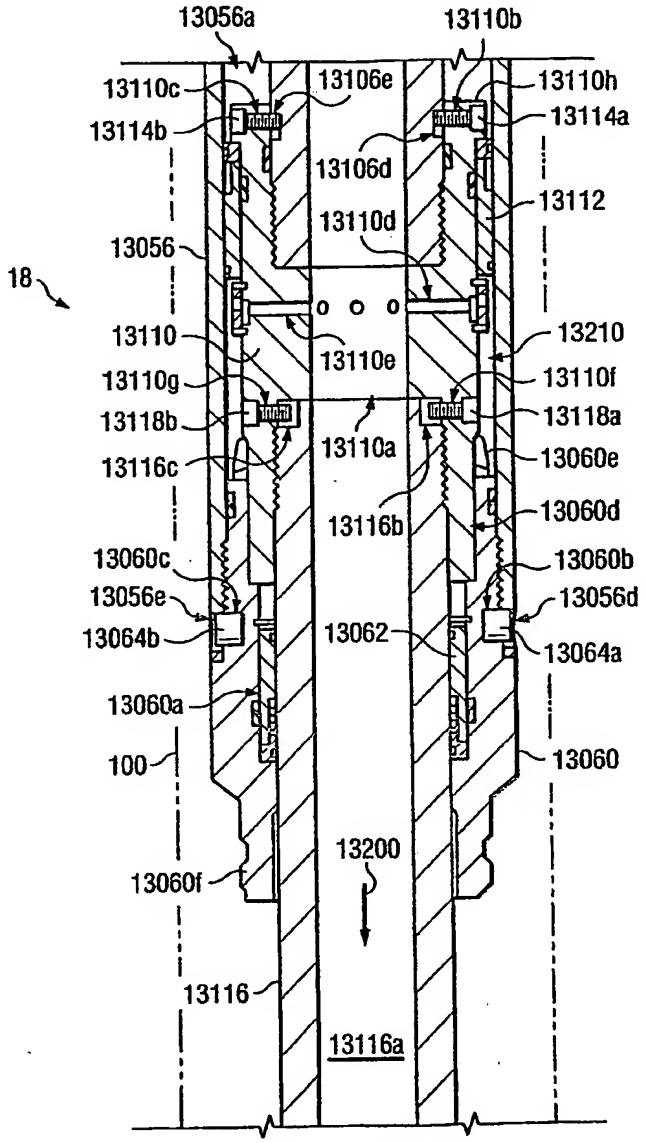

Fig. 13A7

25791.253

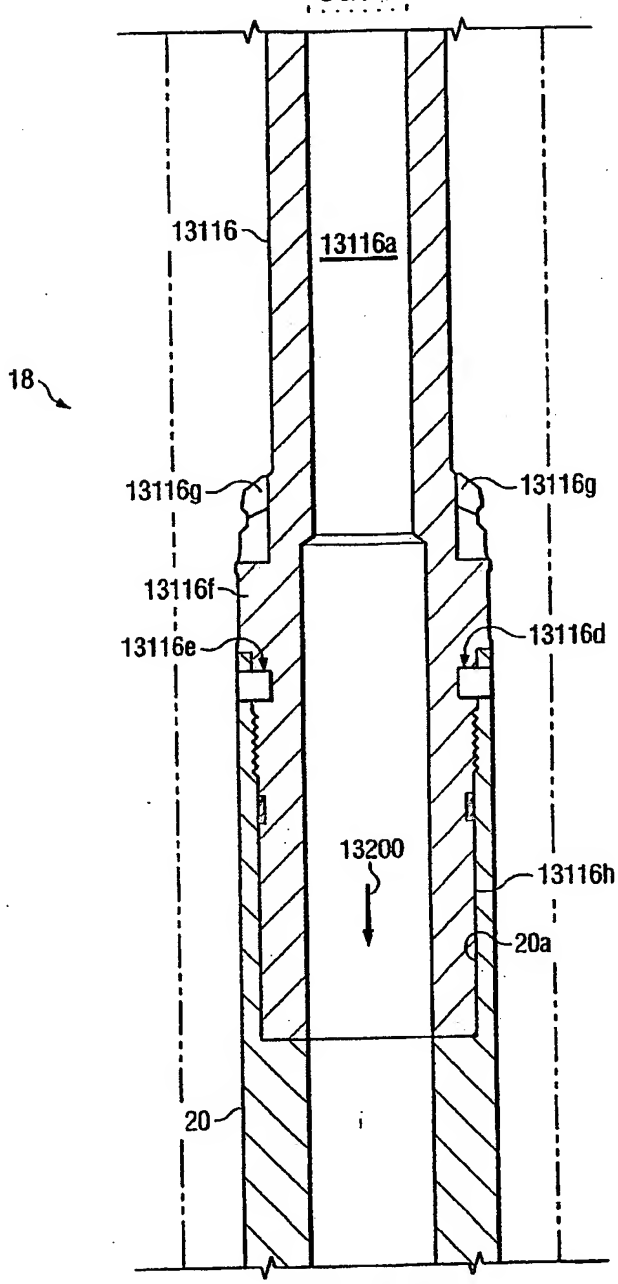

Fig. 13A8

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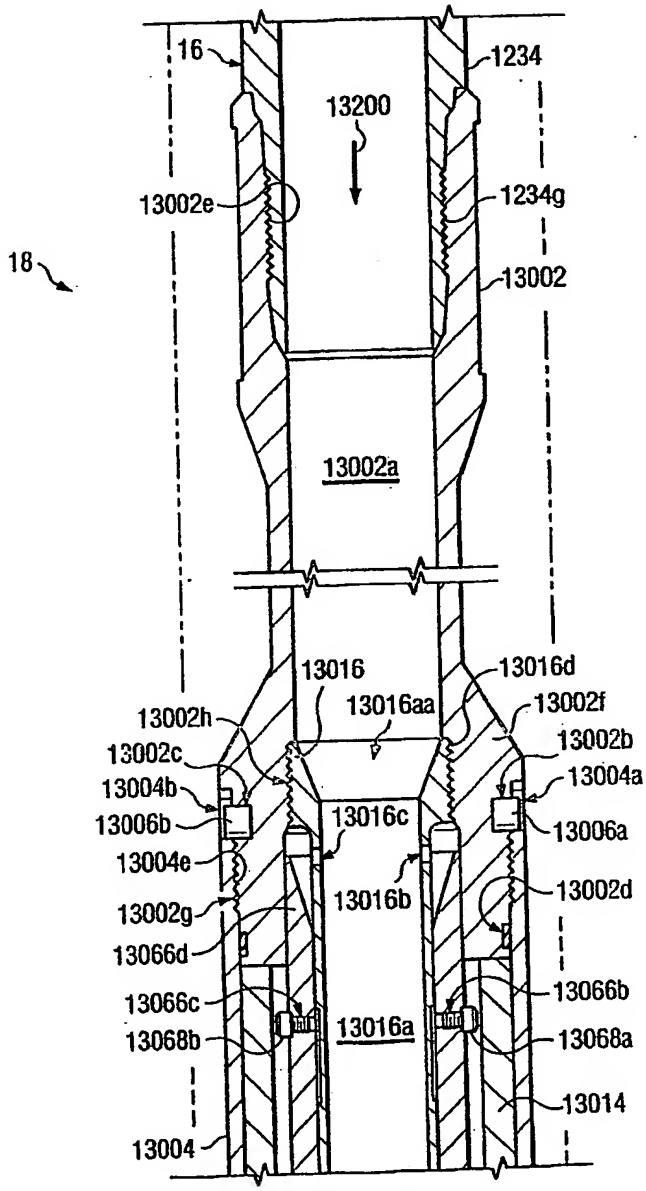

Fig. 13B1

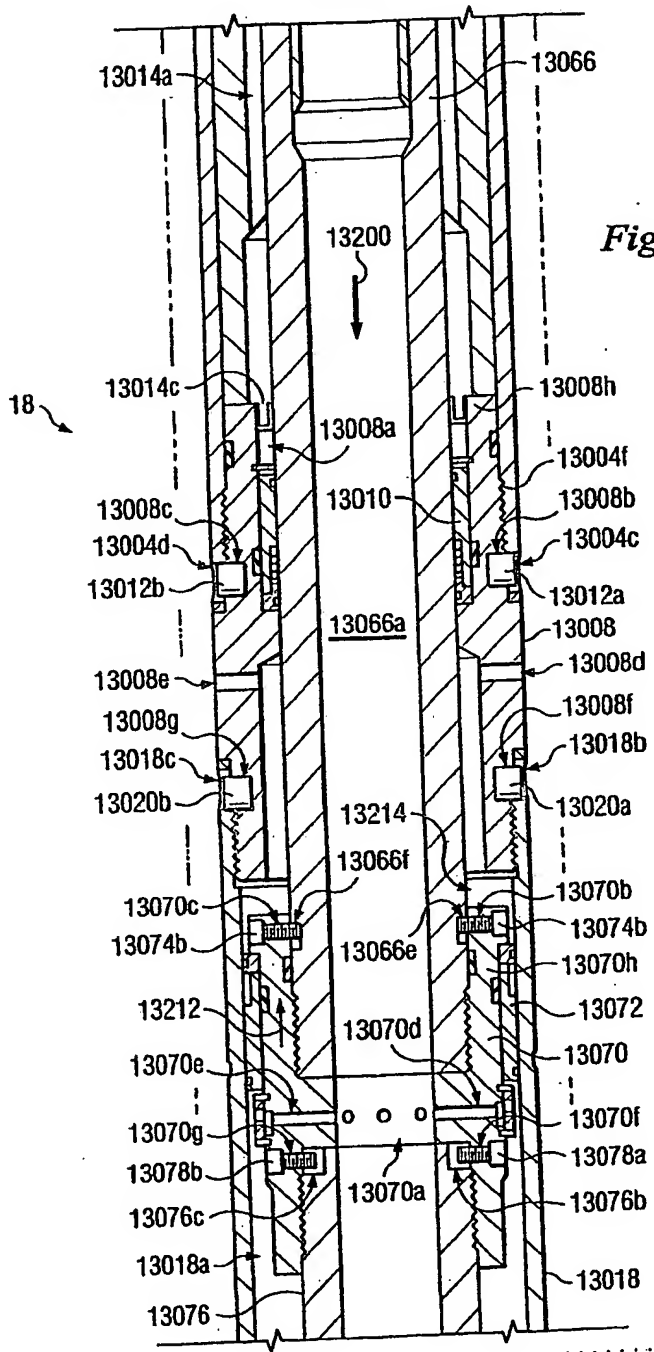
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Fig. 13B2

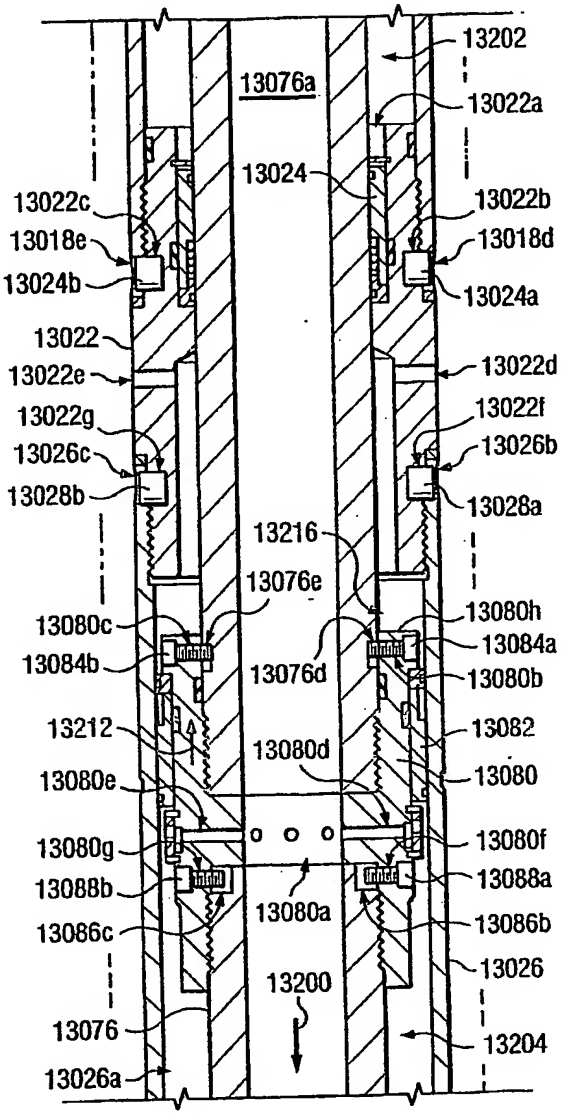
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Fig. 13B3

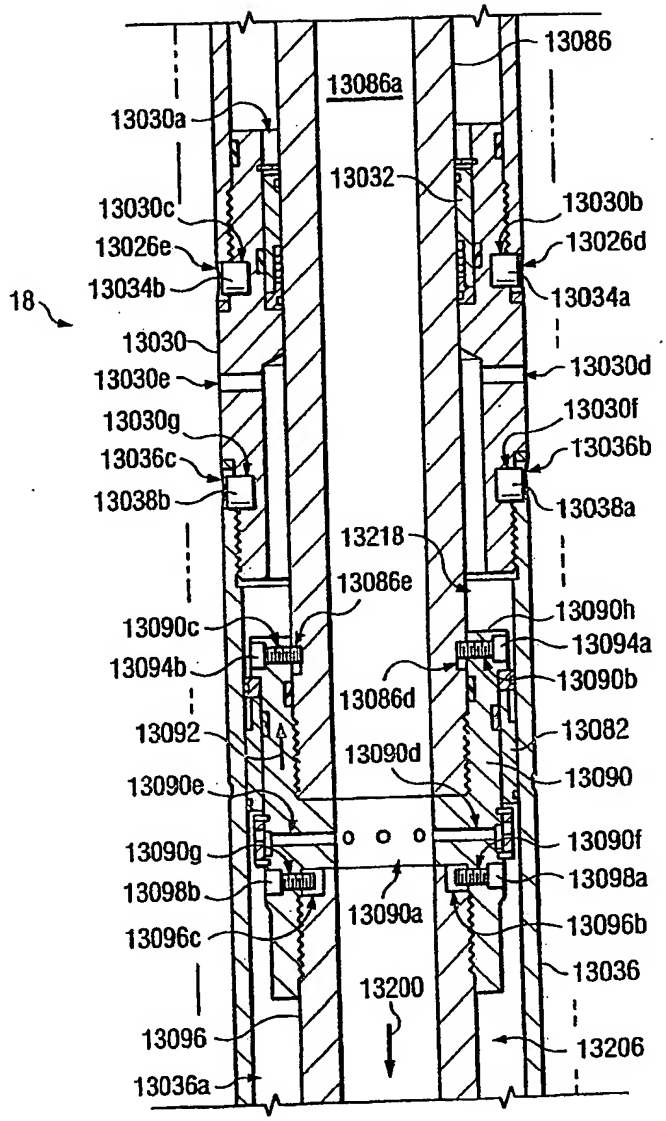
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Fig. 13B4

25791.253

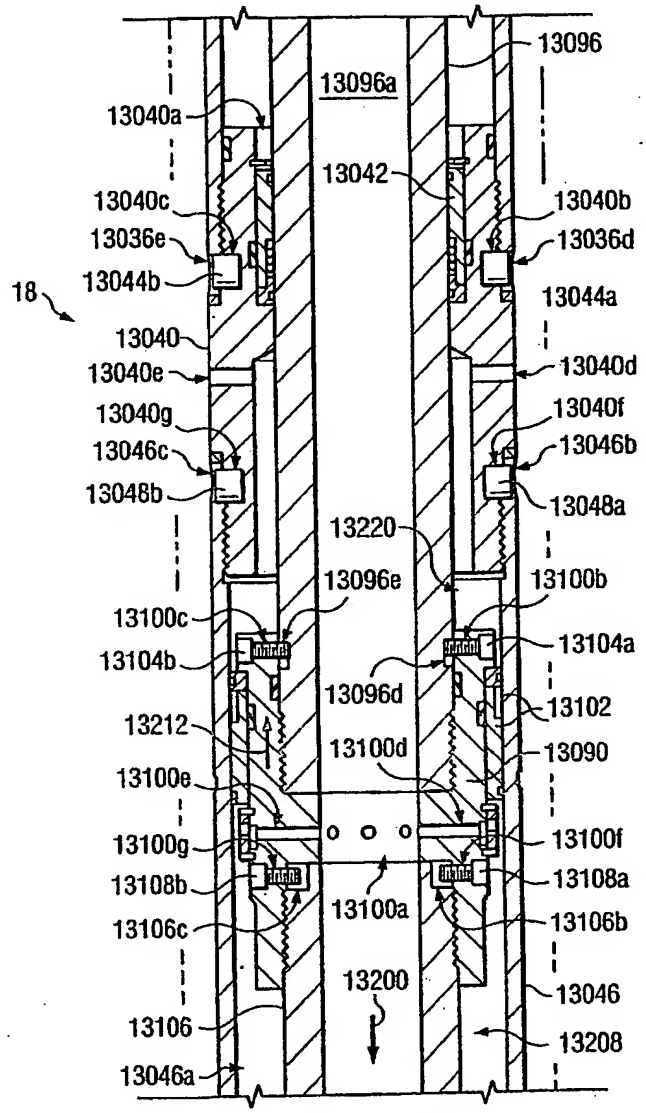

Fig. 13B5

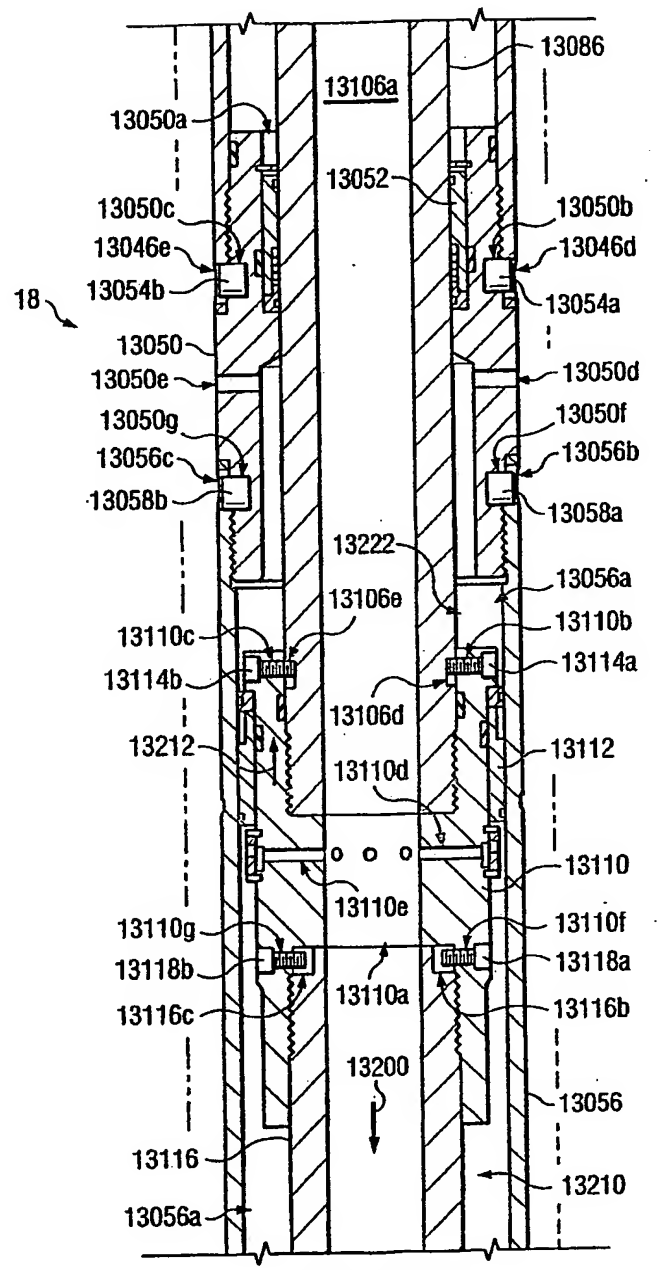
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Fig. 13B6

25791.253

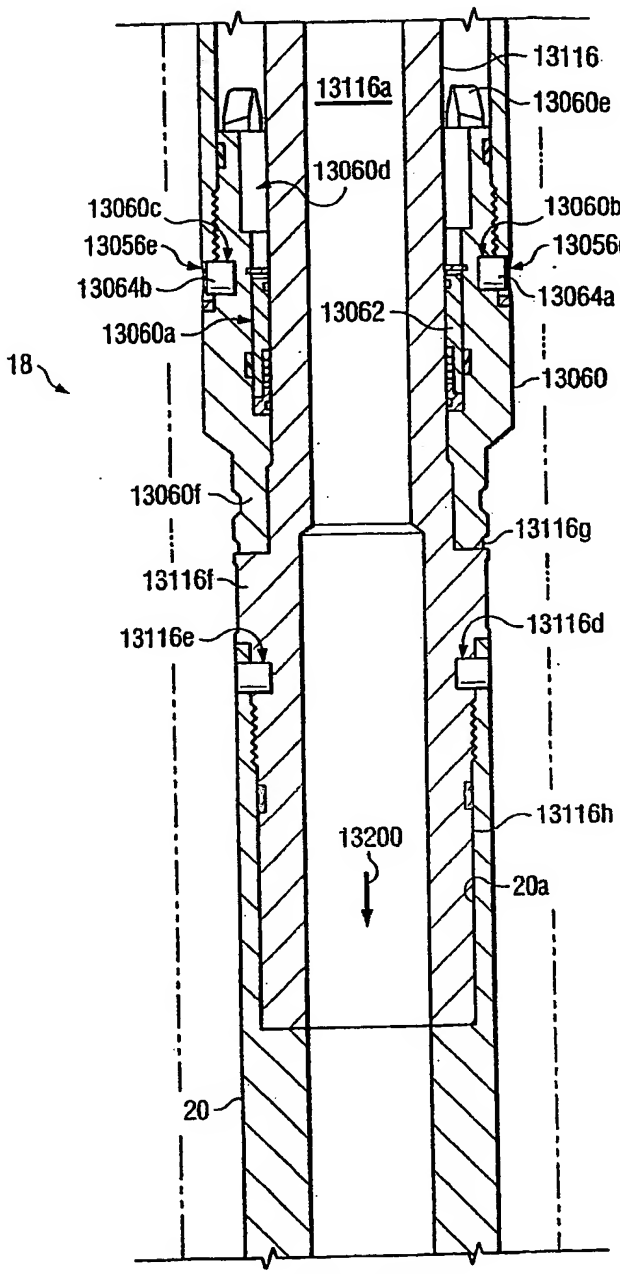
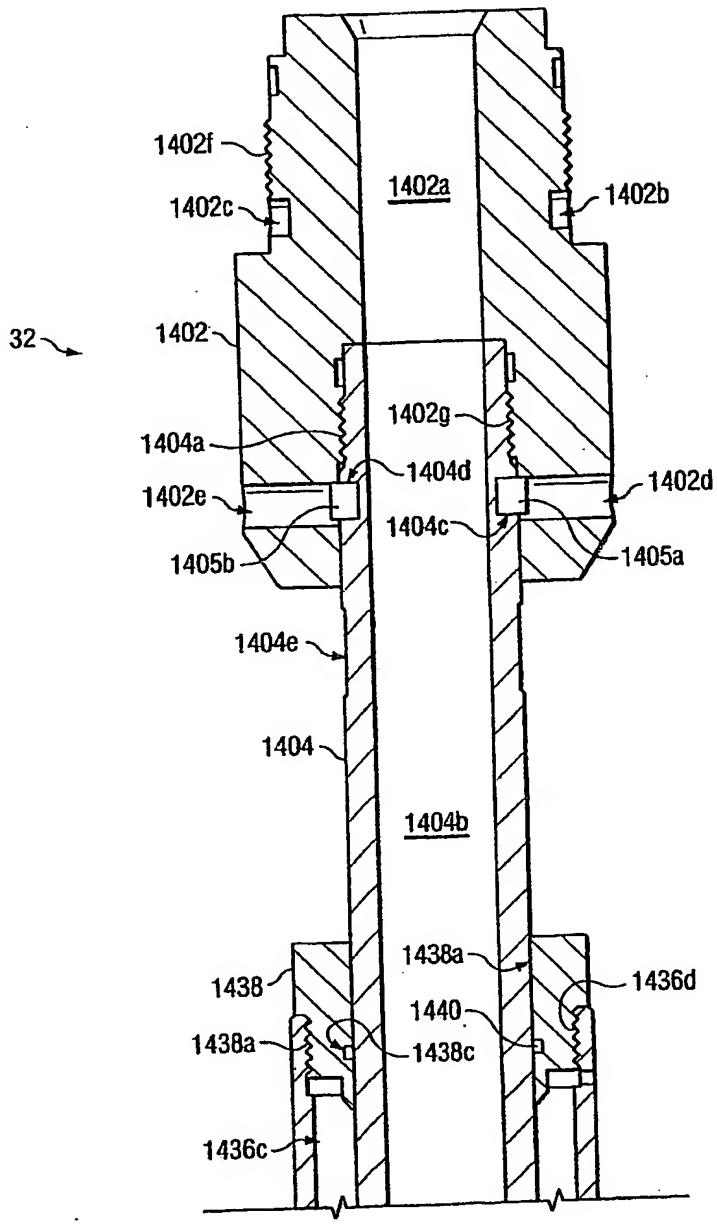


Fig. 13B7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1436c

Fig. 14A

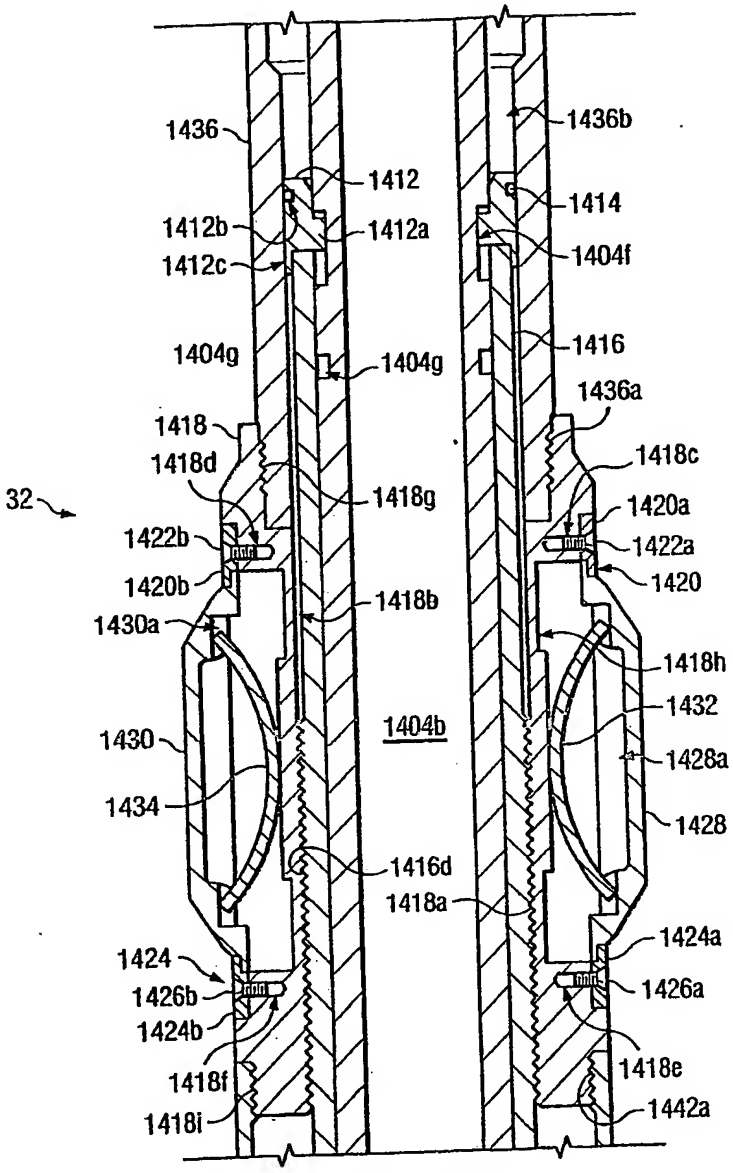
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Fig. 14B

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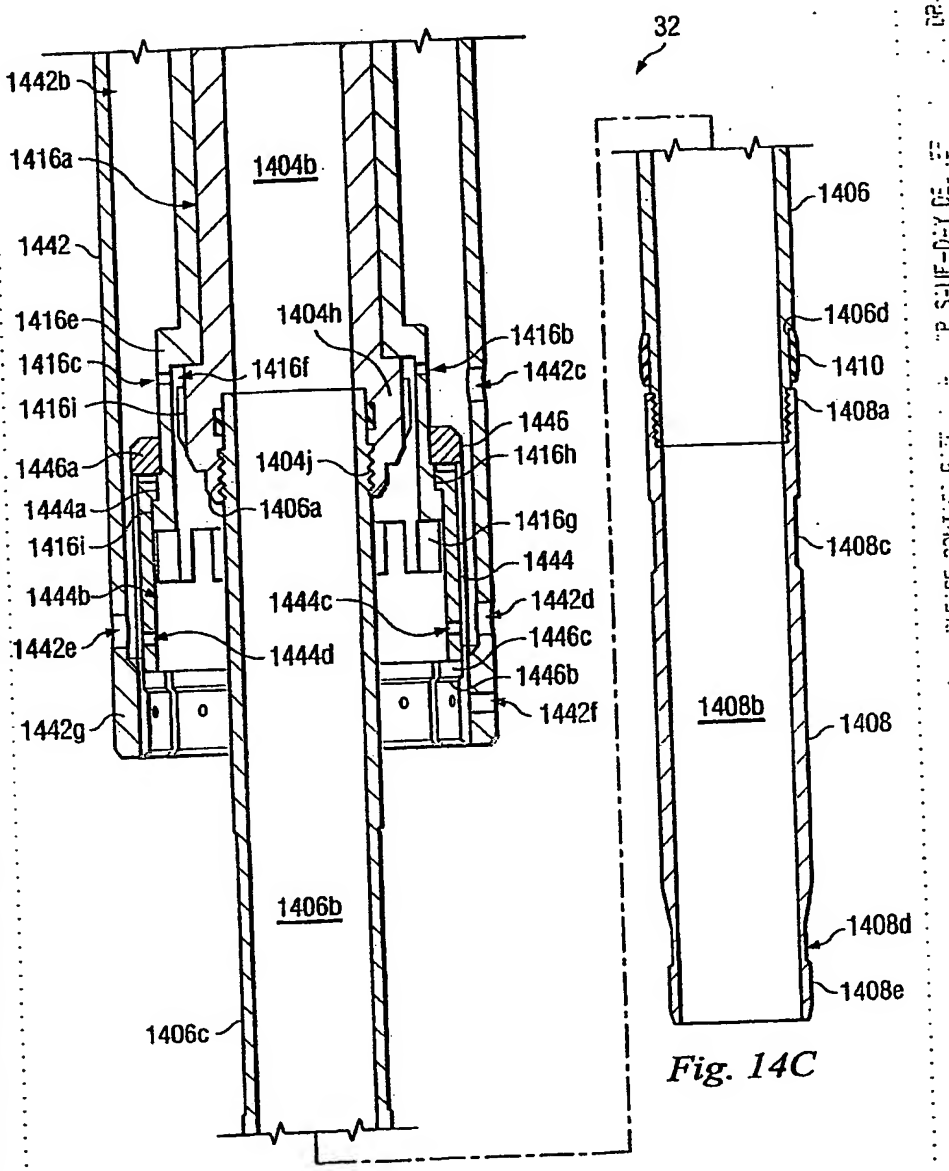

Fig. 14C

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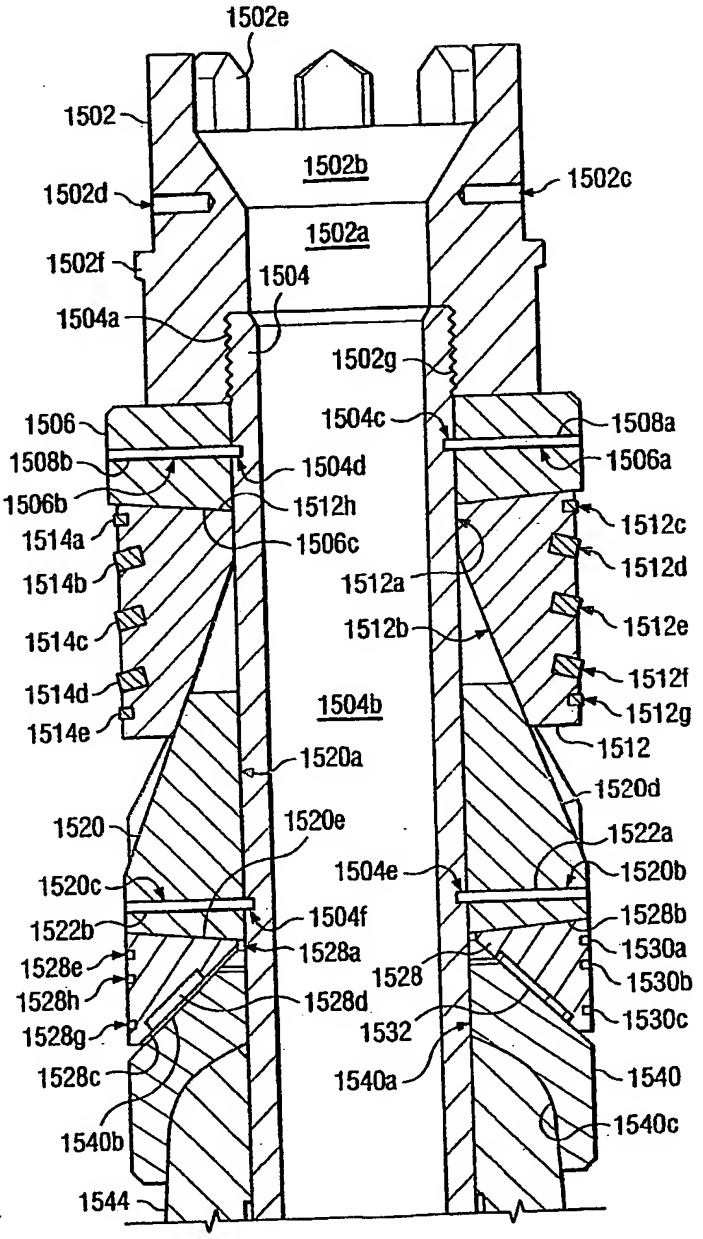

Fig. 15-1

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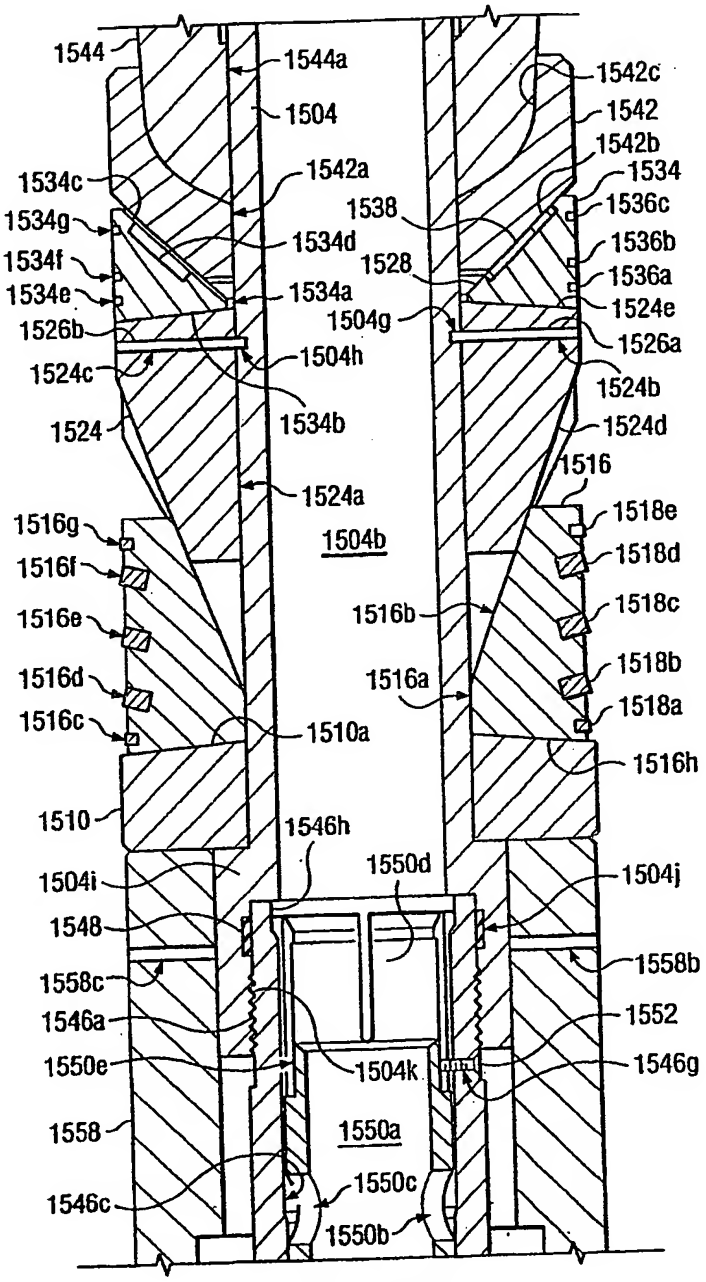

Fig. 15-2

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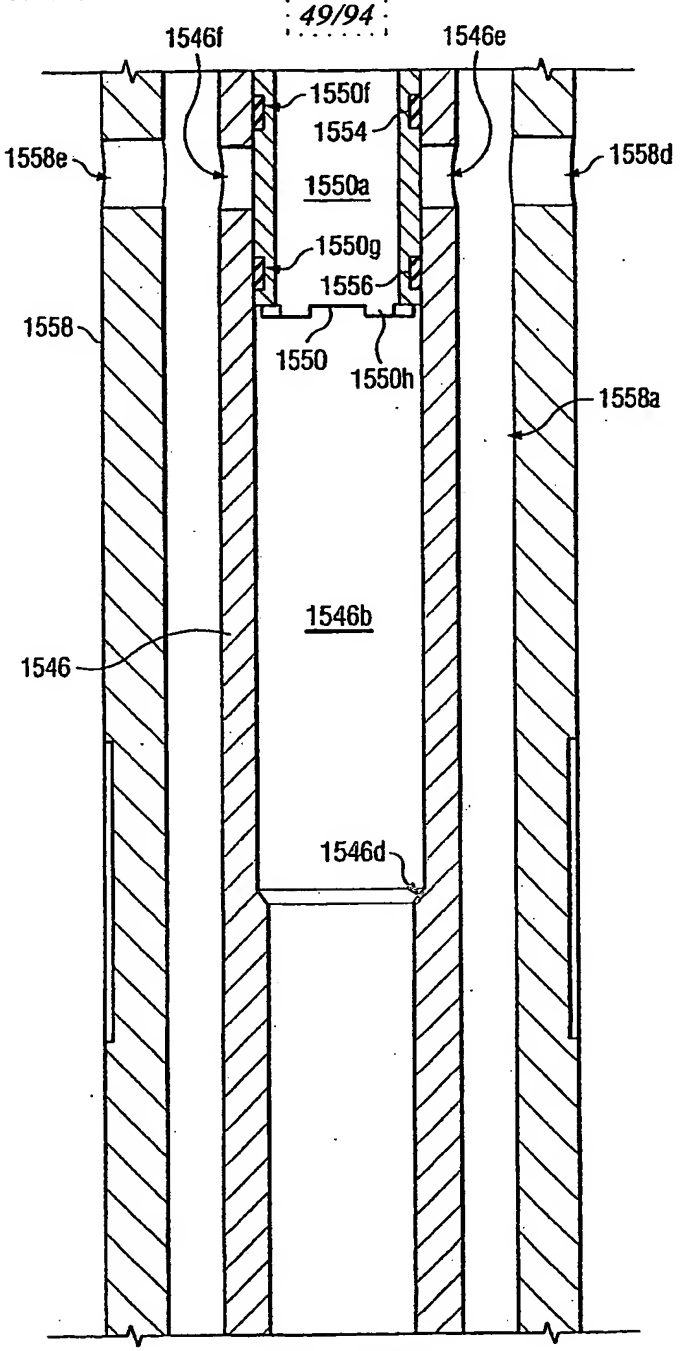

Fig. 15-3

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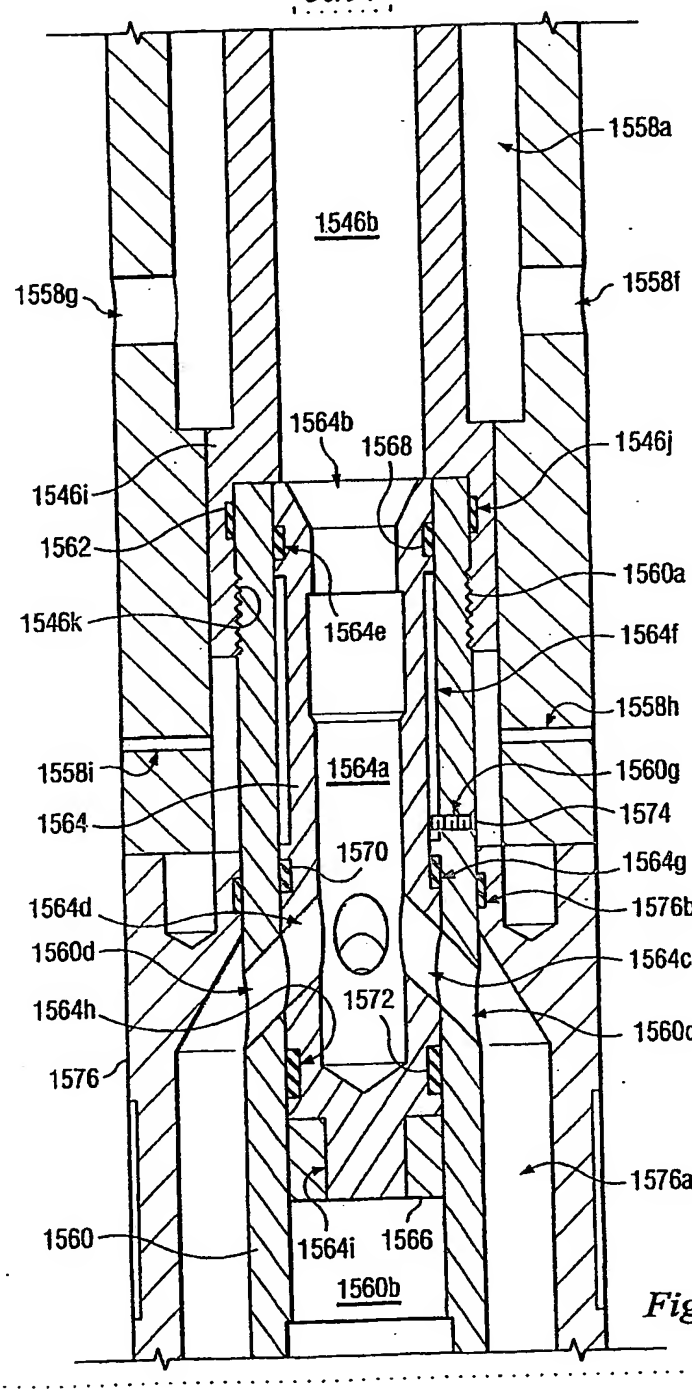

Fig. 15-4

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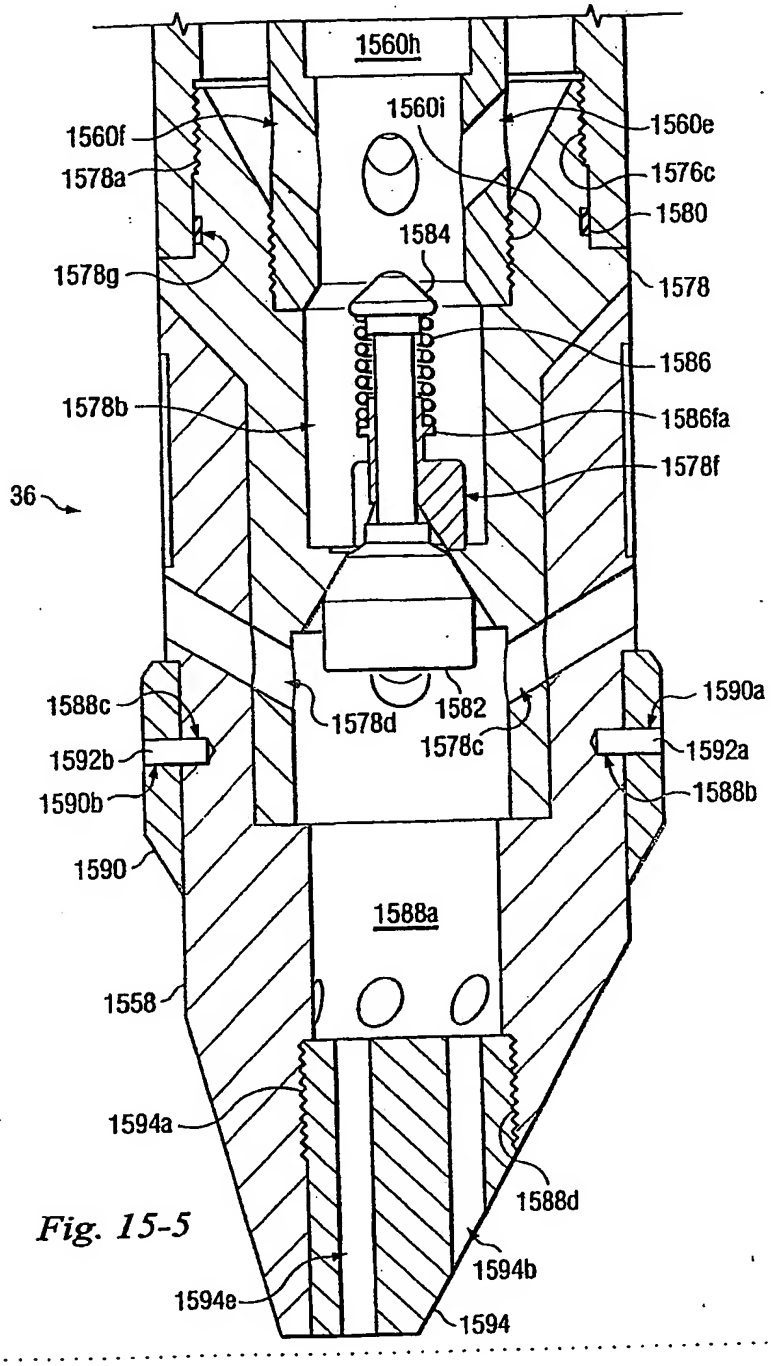


Fig. 15-5

DRAFT DRAWINGS ** PLEASE DO NOT FILE WITH THIS COPY!! PLEASE CONTACT PATENT ART FOR SAME-DAY DELIVERY OF FINAL DRAWINGS

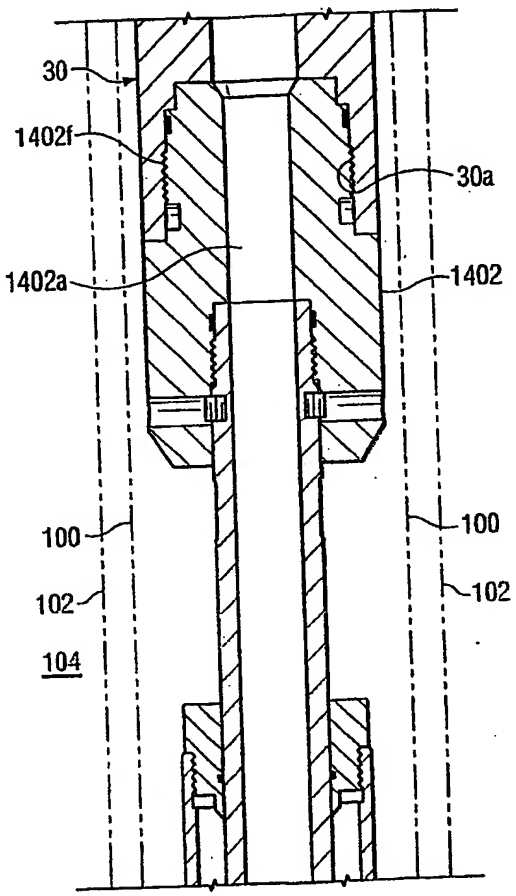


Fig. 16A1

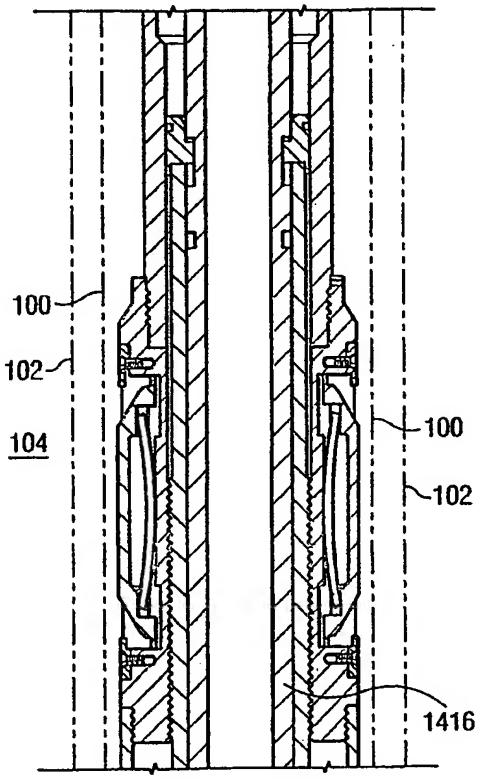


Fig. 16A2

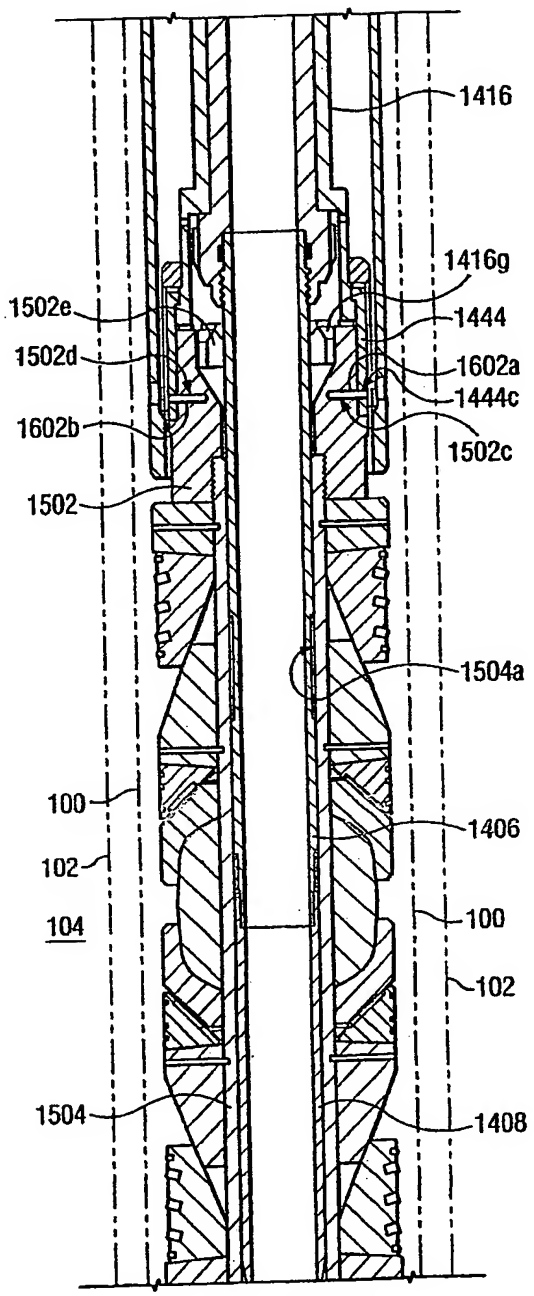
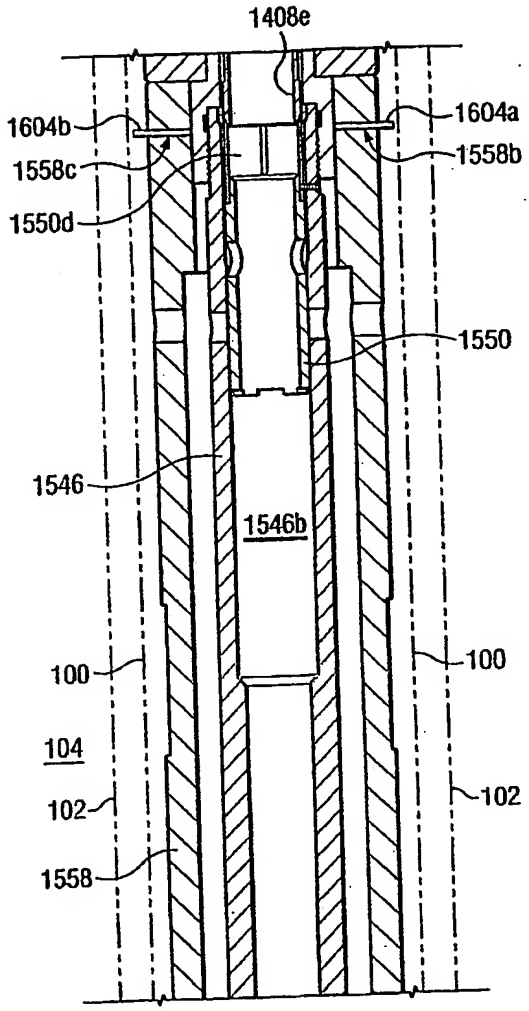


Fig. 16A3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1558b
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1550
1546
1546b
100
100
104
102
102
1558

Fig. 16A4

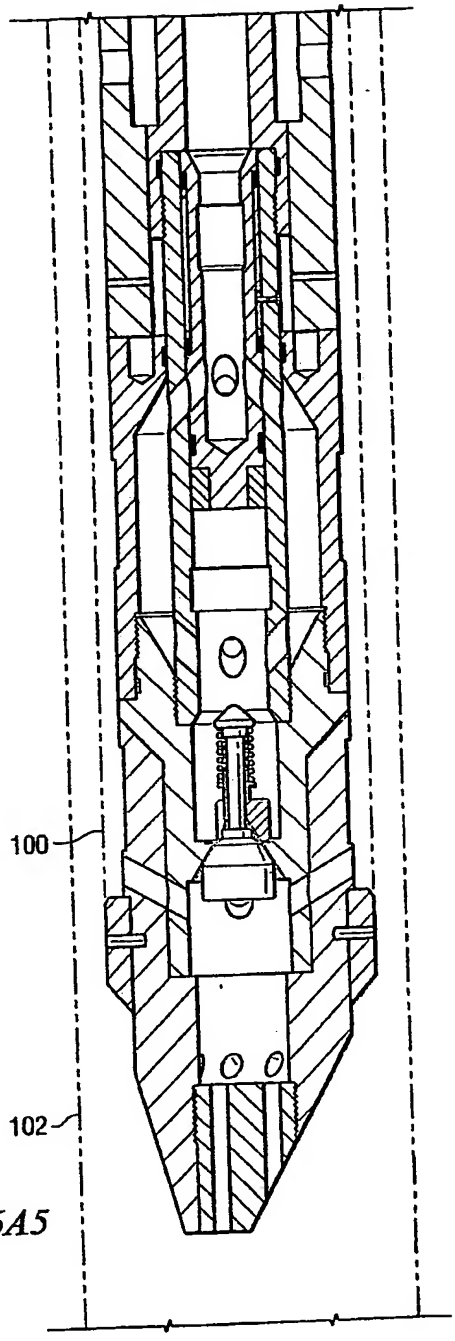


Fig. 16A5

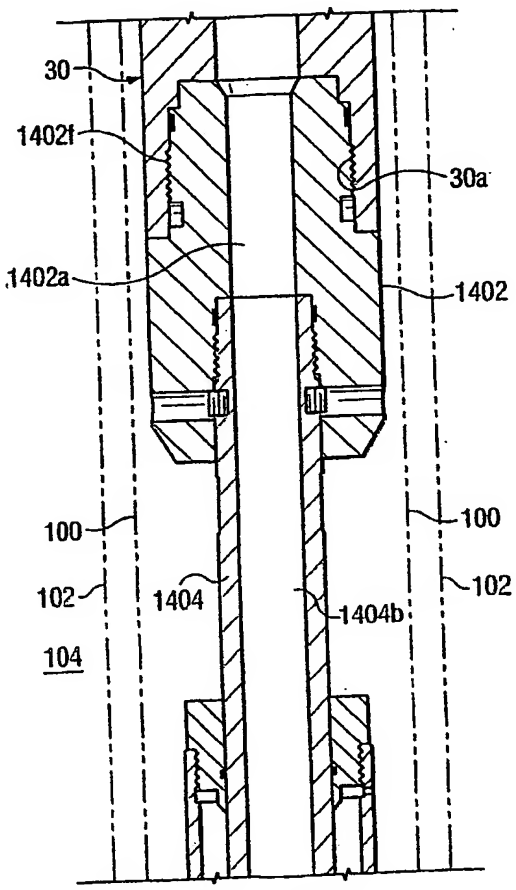


Fig. 16B1

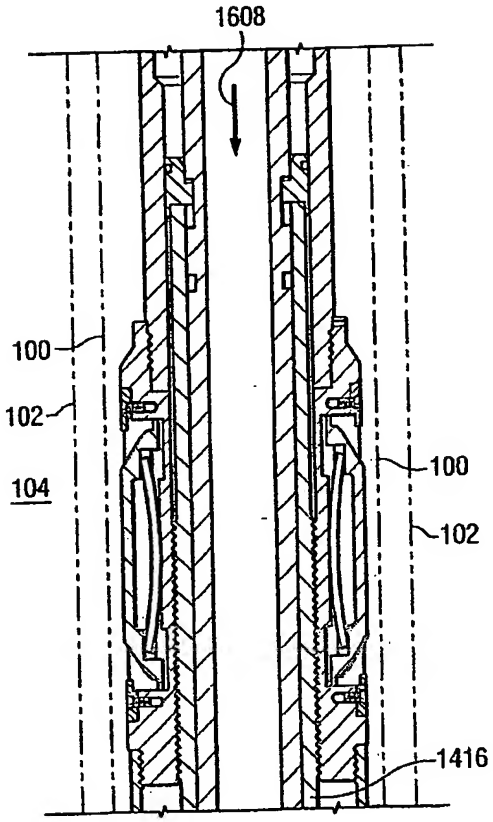


Fig. 16B2

25791.253

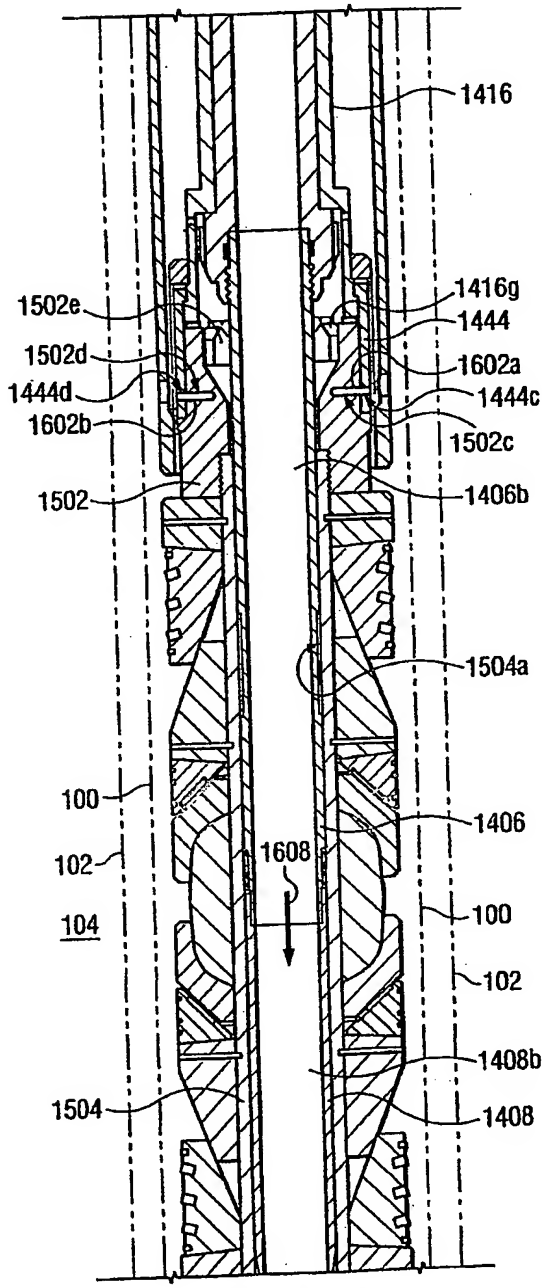
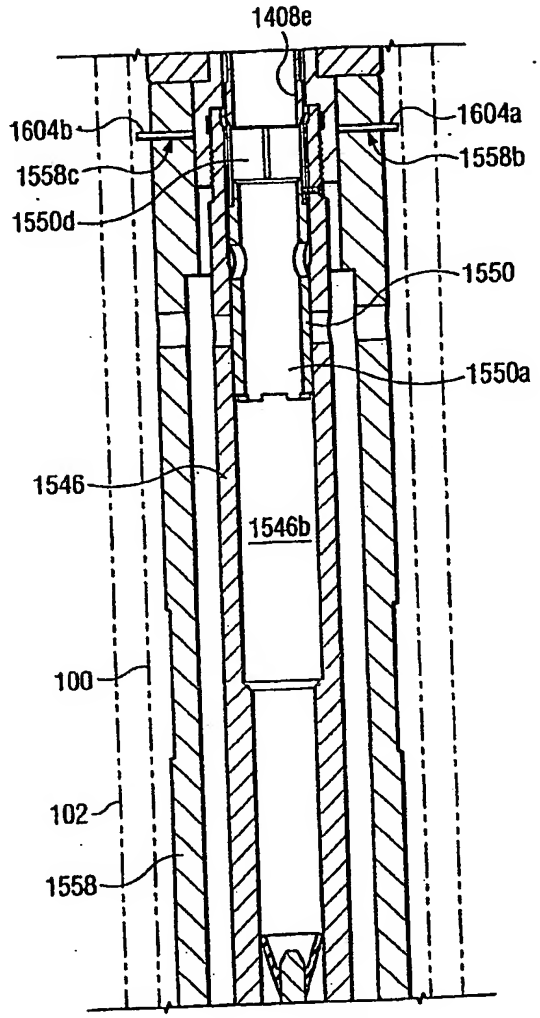


Fig. 16B3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1550a
1546
1546b
100
102
1558

Fig. 16B4

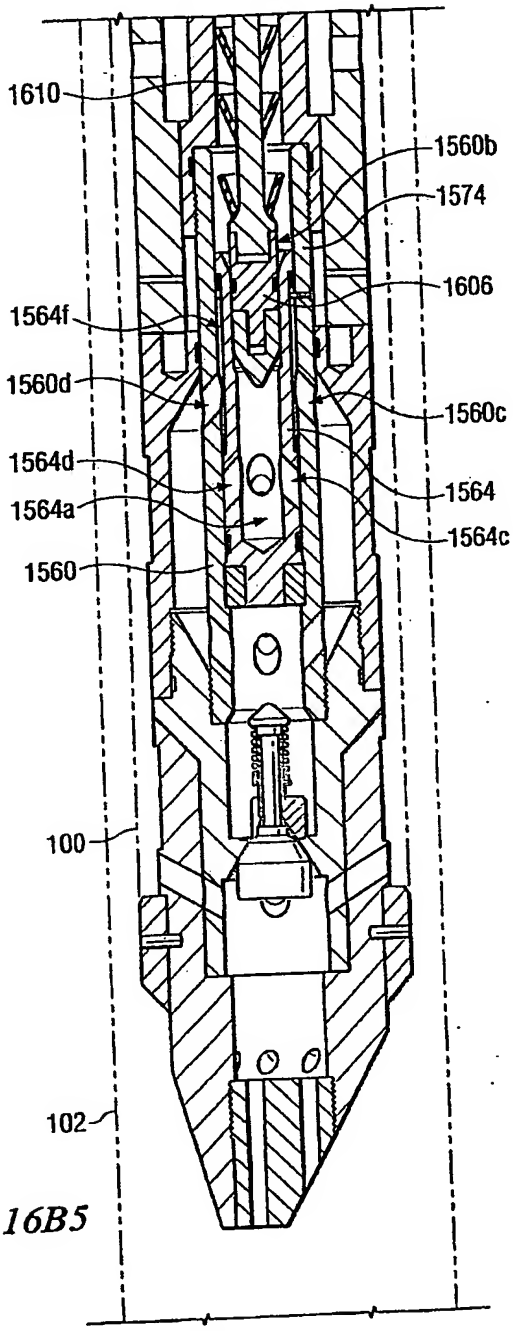

Fig. 16B5

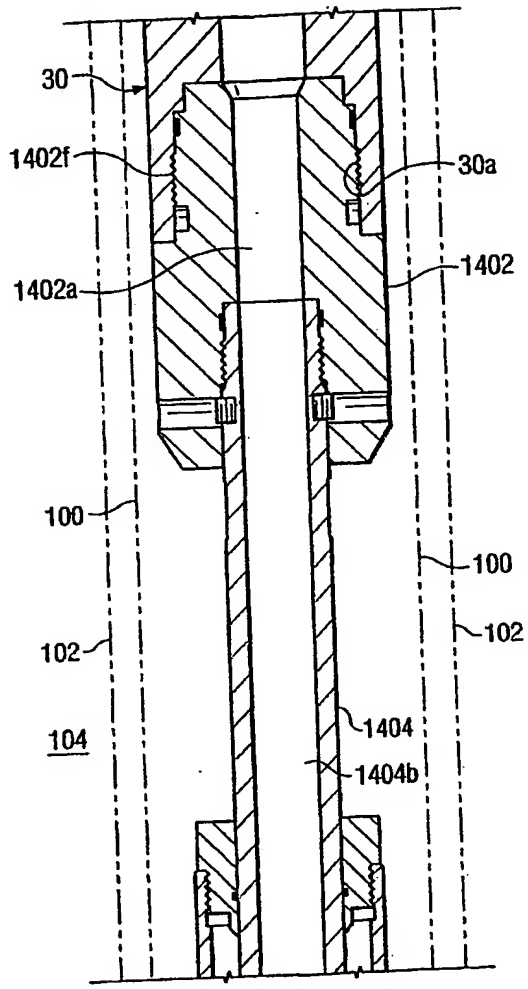

Fig. 16C1

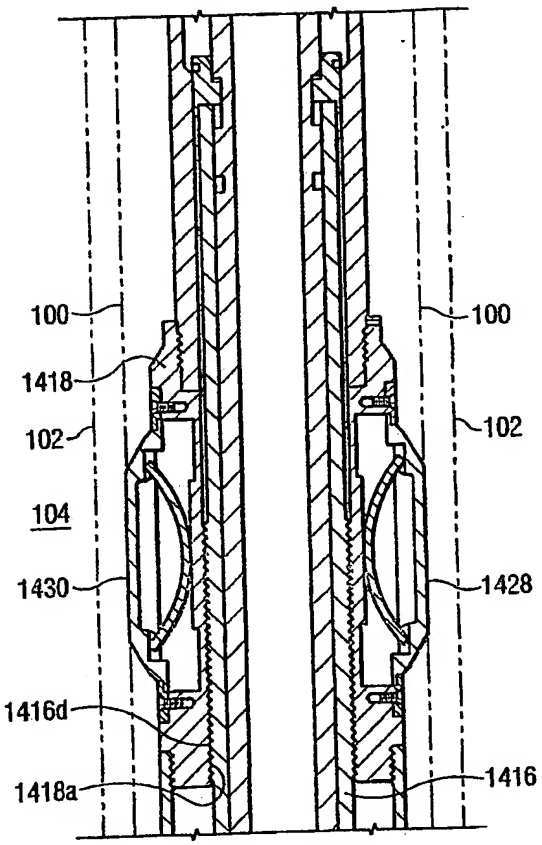

Fig. 16C2

A4

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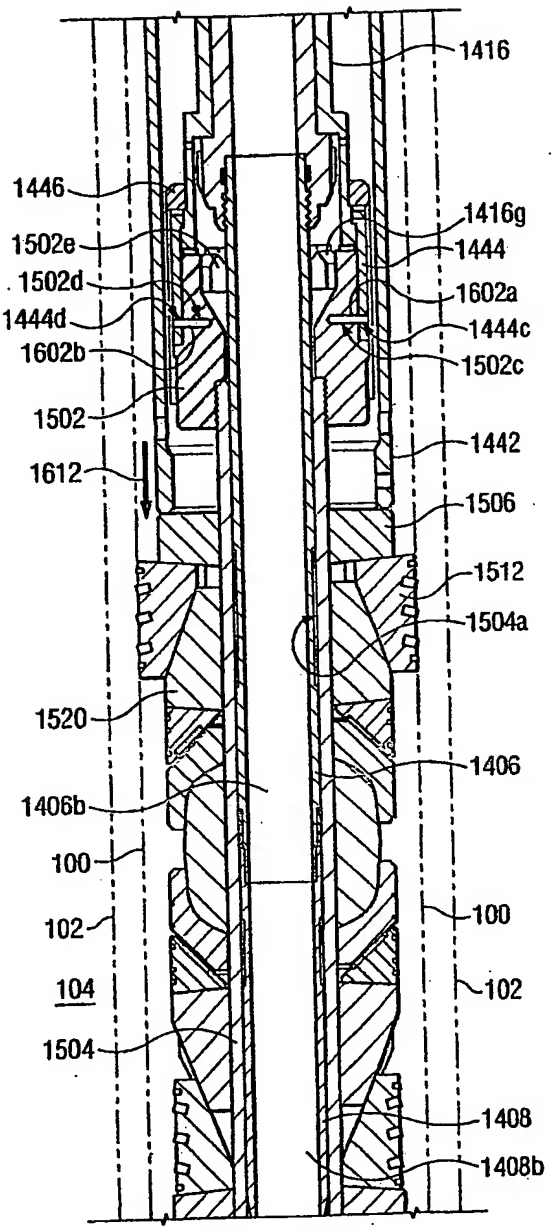
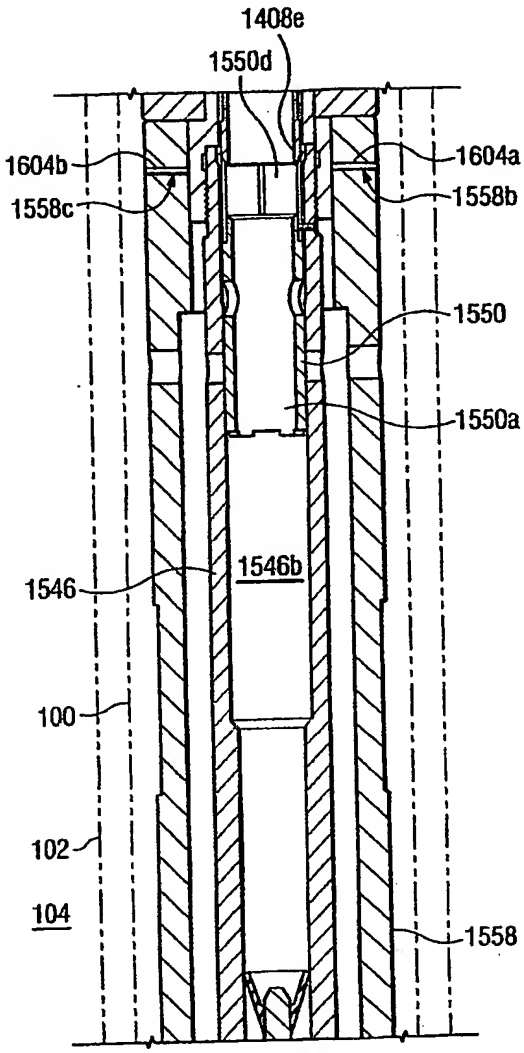


Fig. 16C3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1550
1550a
1546b
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100
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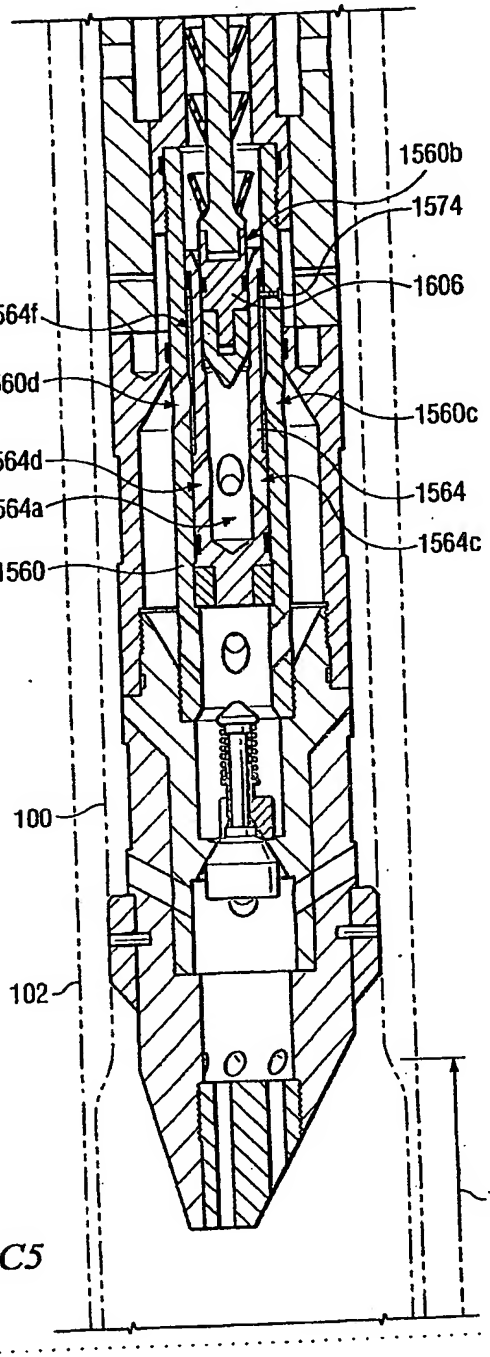
104
1558

Fig. 16C4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1564a
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1560
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36
112

Fig. 16C5

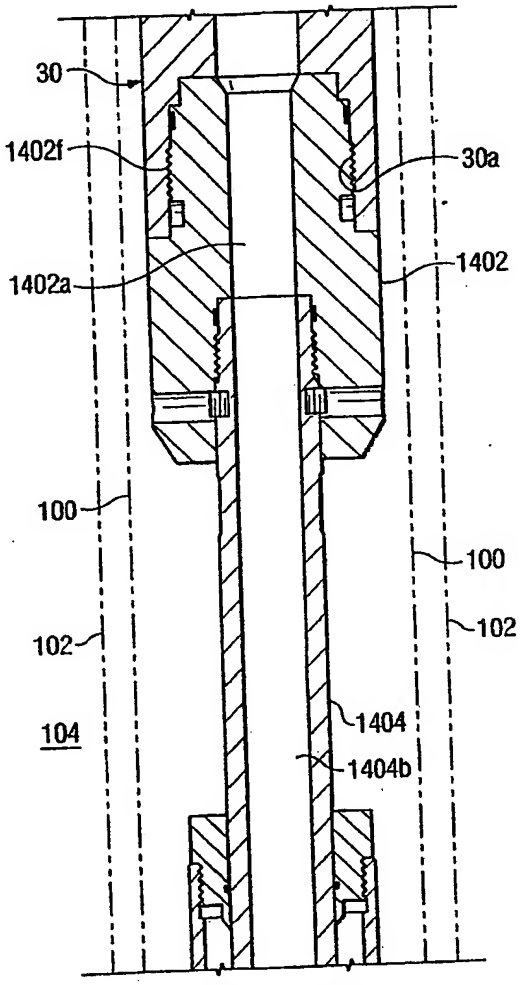

Fig. 16D1

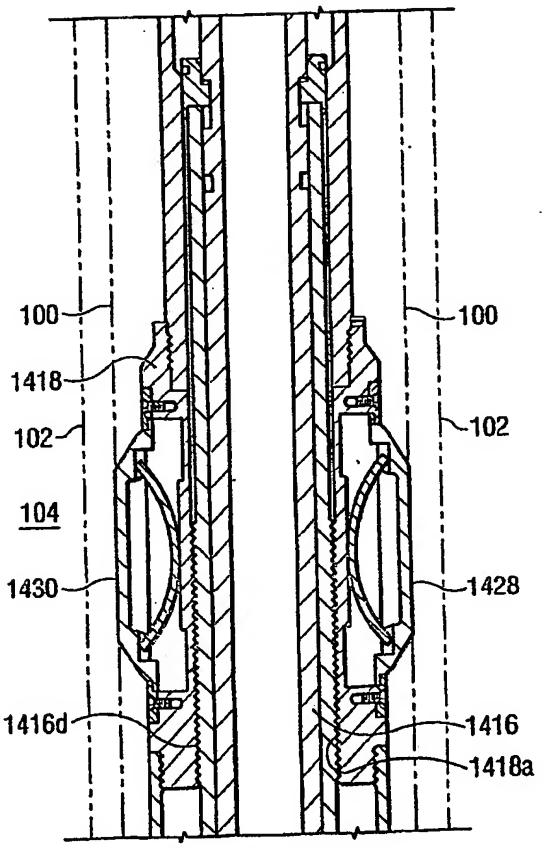

Fig. 16D2

25791.253

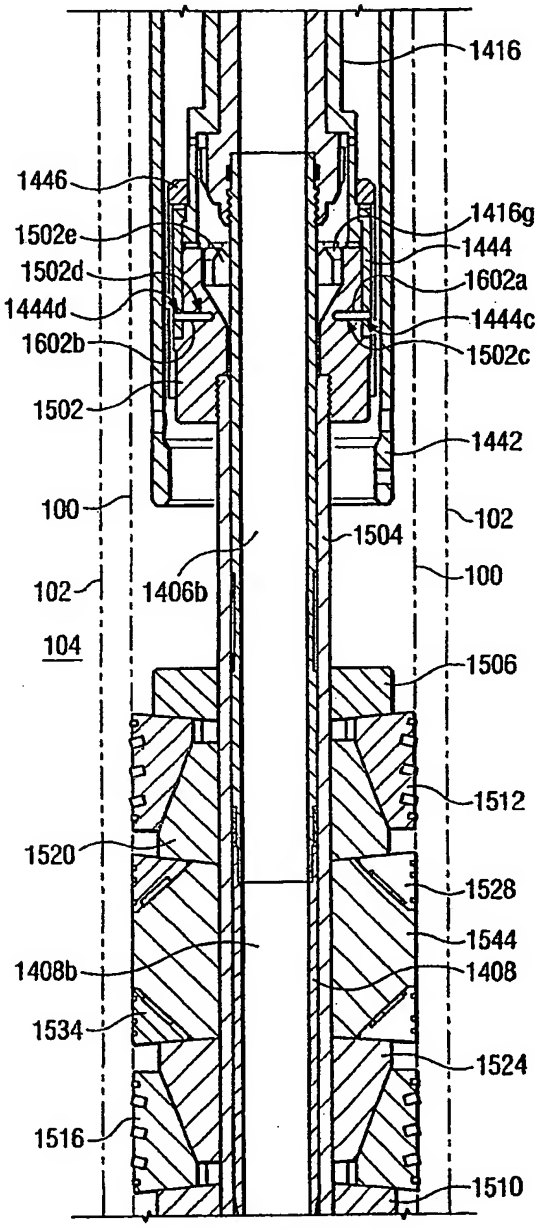

Fig. 16D3

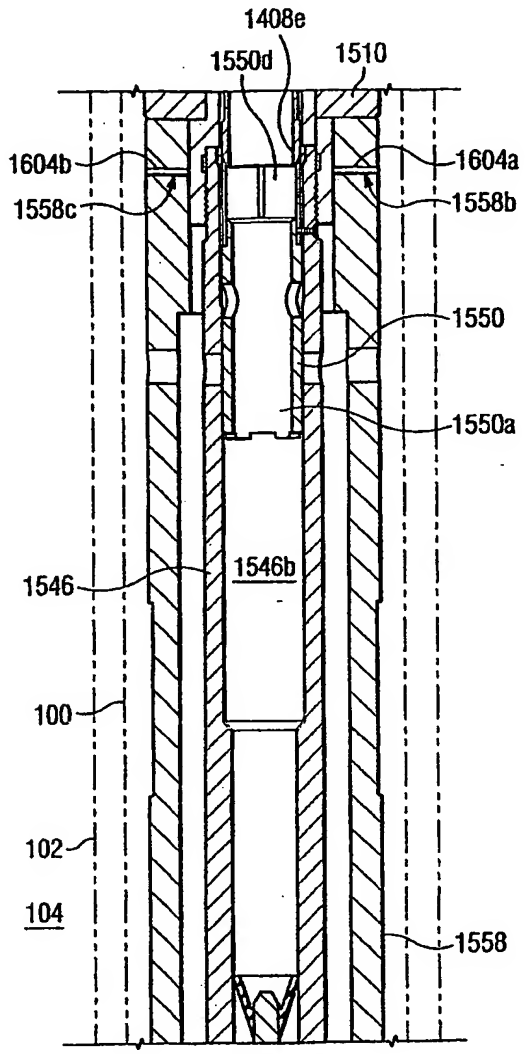

Fig. 16D4

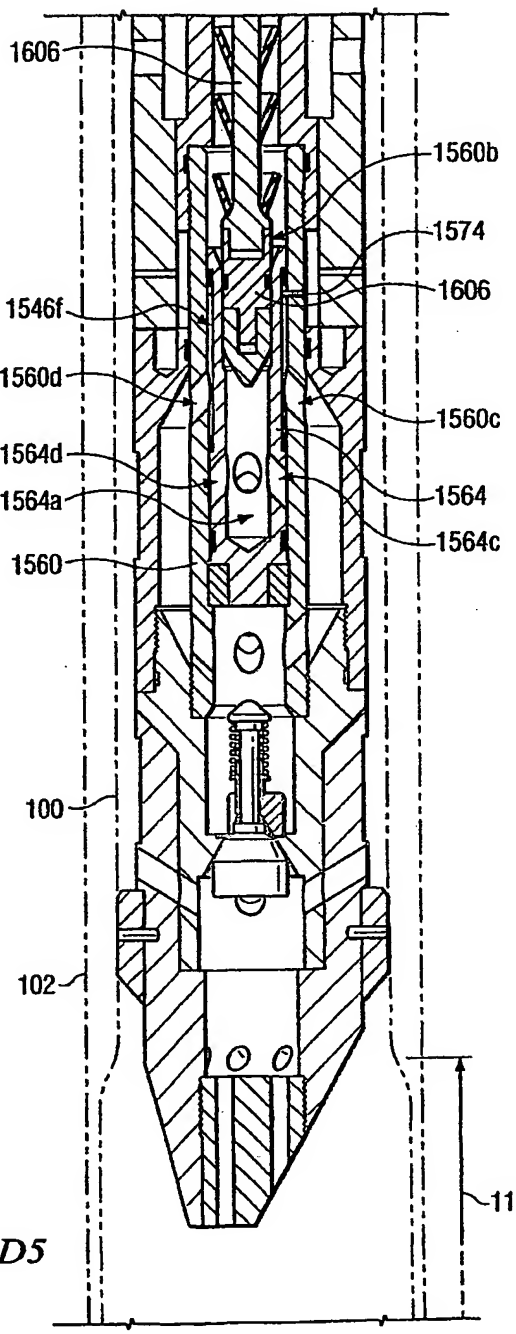

Fig. 16D5

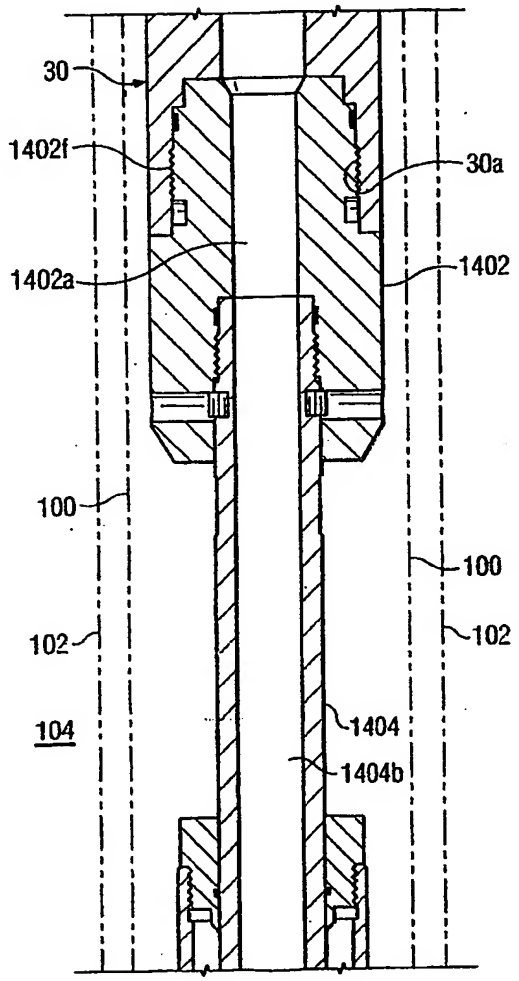

Fig. 16E1

A4

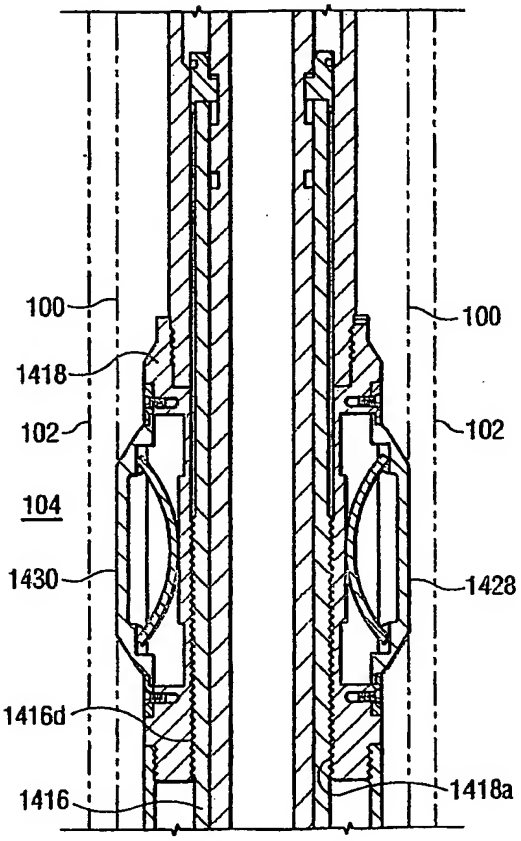

Fig. 16E2

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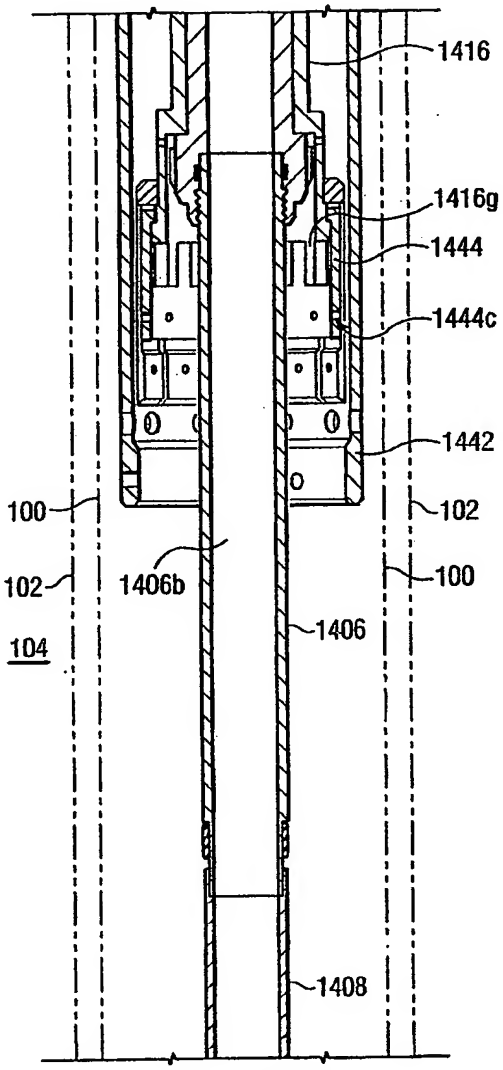
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1444c
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1406b
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100
104
1406
1408

Fig. 16E3

25791.253

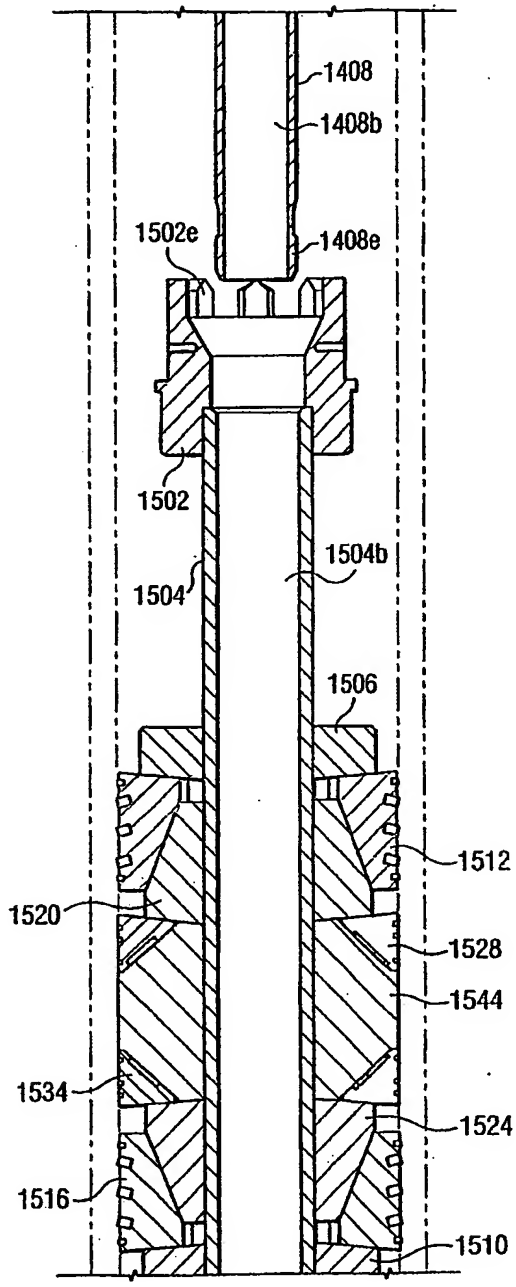

Fig. 16E4

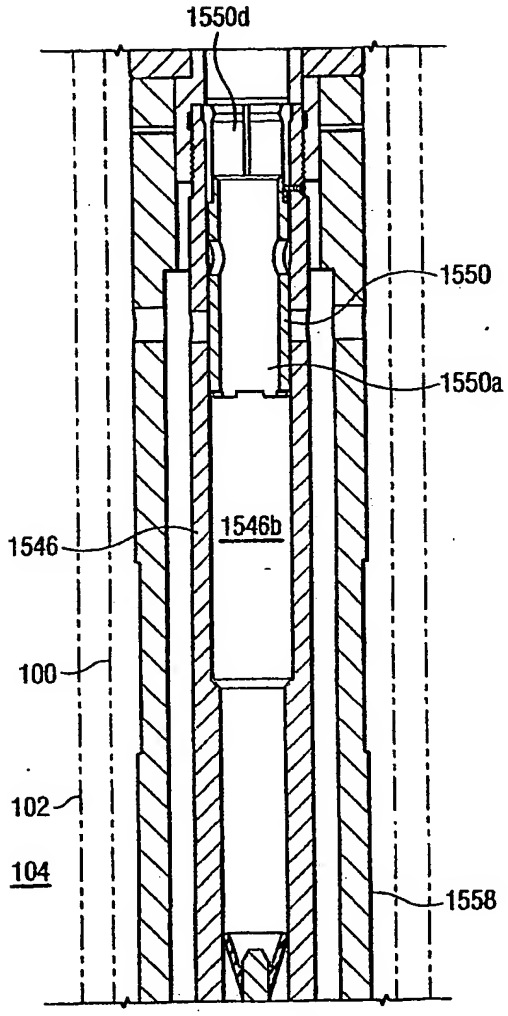

Fig. 16E5

25791.253

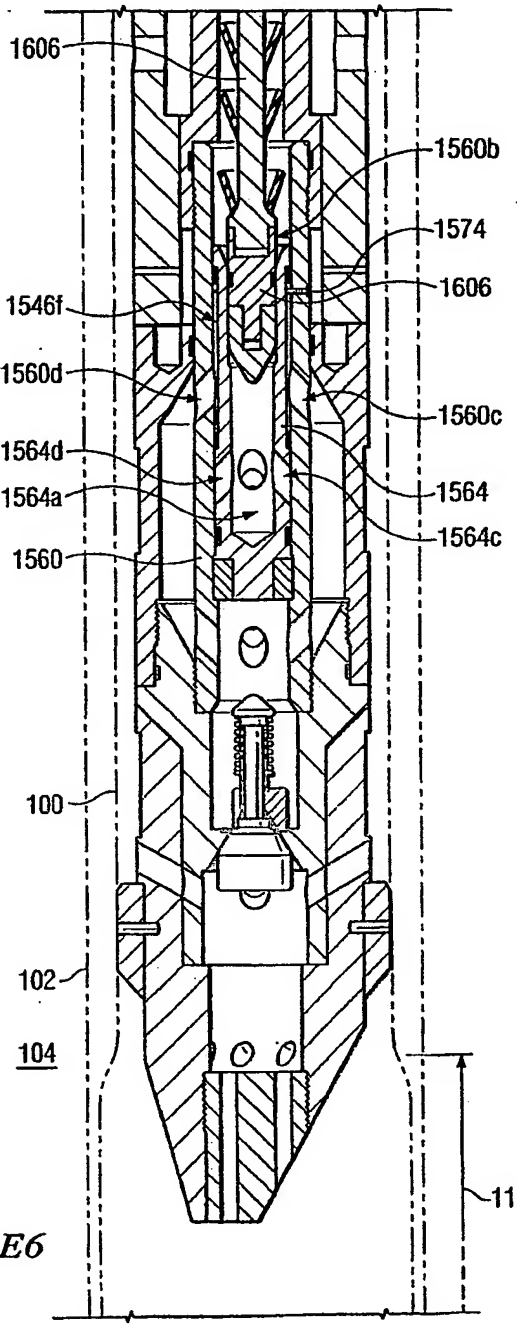

Fig. 16E6

25791.253

A4

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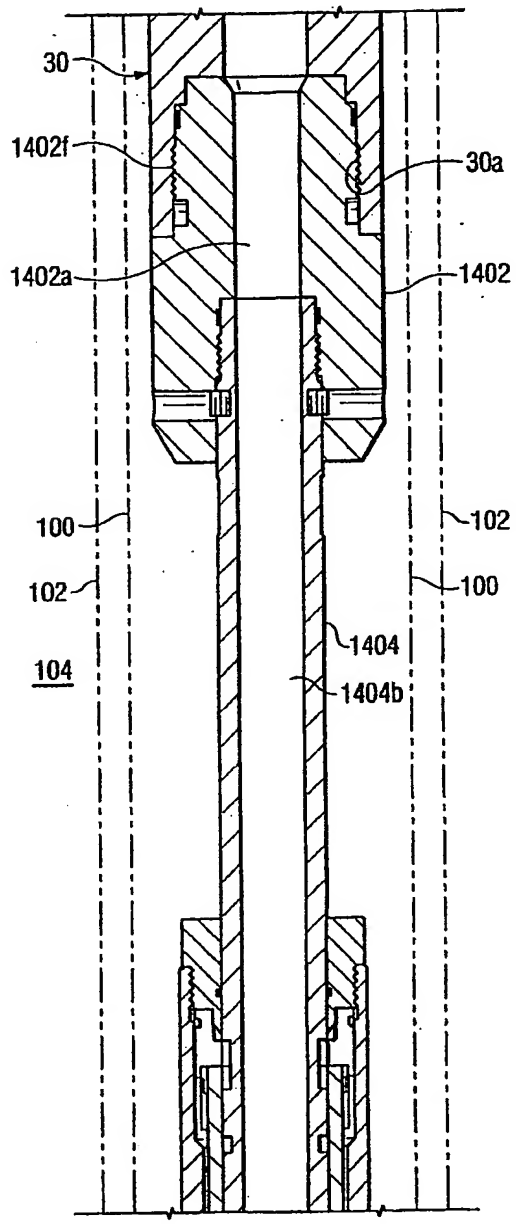
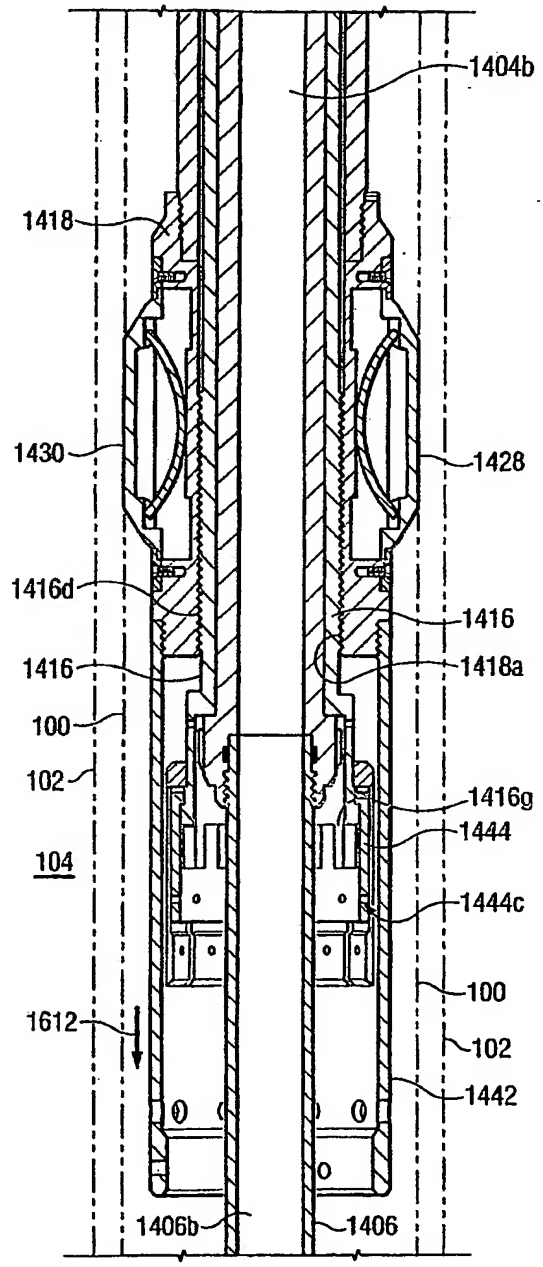


Fig. 16F1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1406b
1406

Fig. 16F2

25791.253

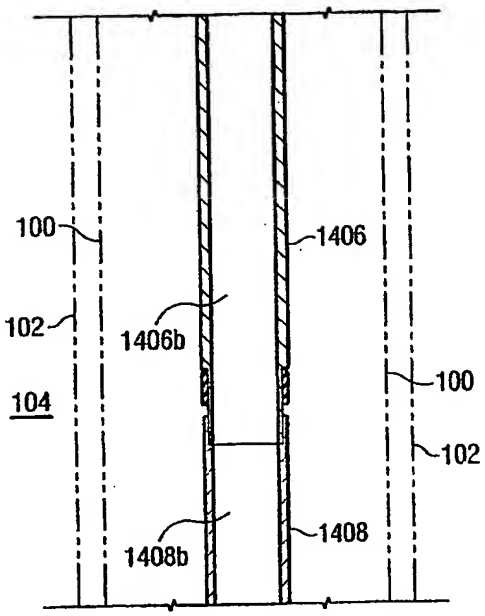

Fig. 16F3

25791.253

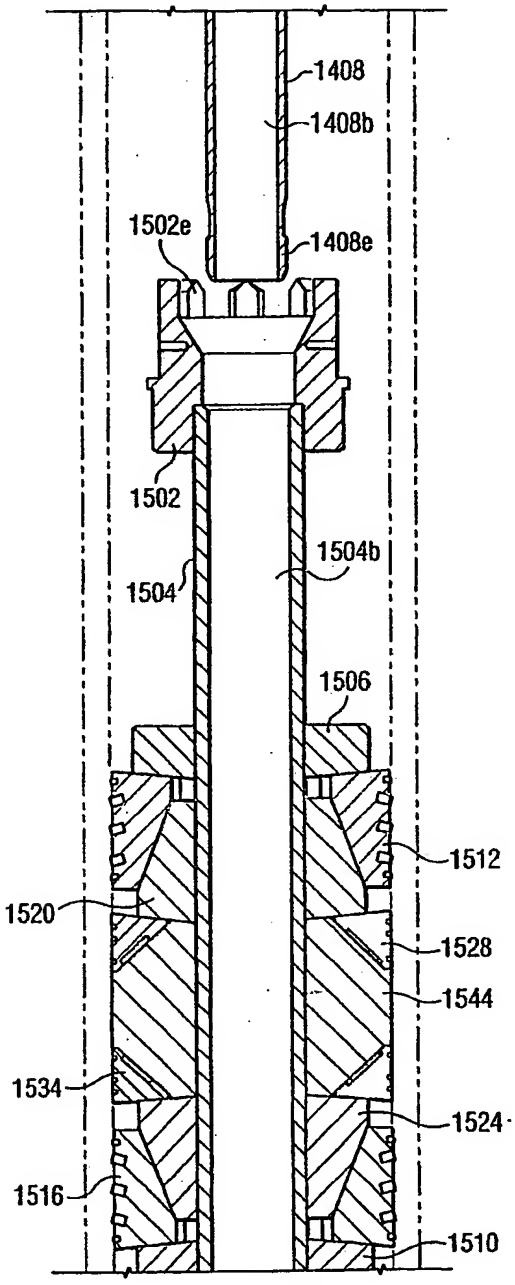

Fig. 16F4

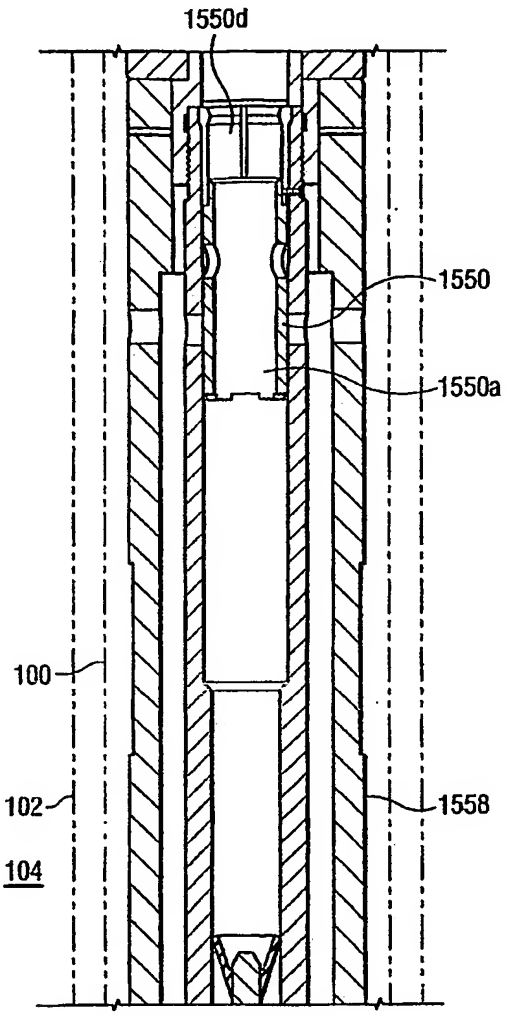

Fig. 16F5

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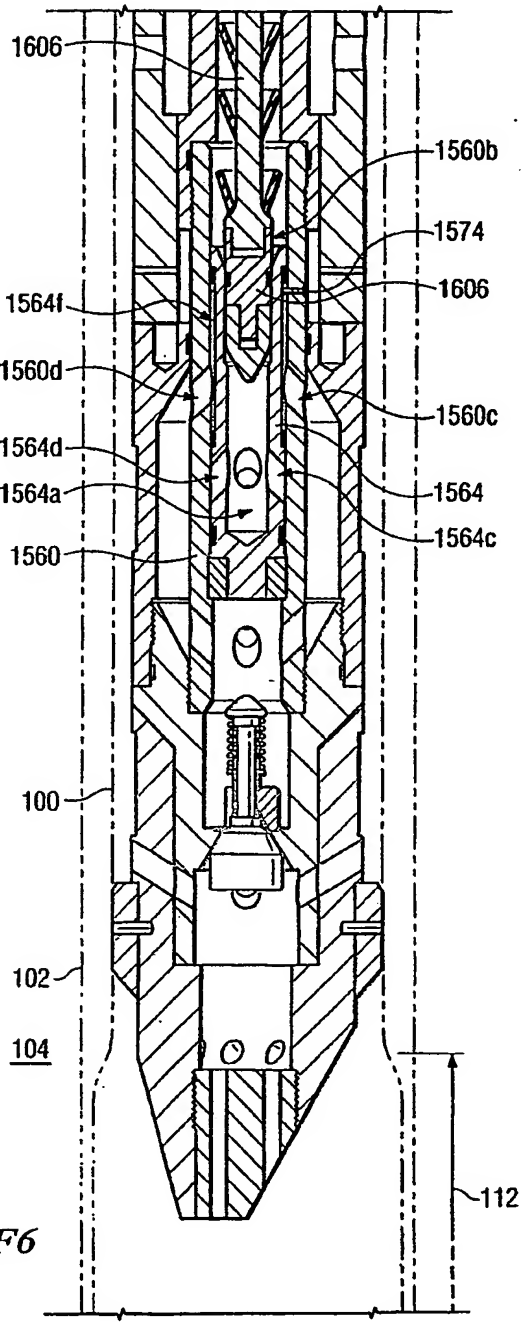

Fig. 16F6

25791.253

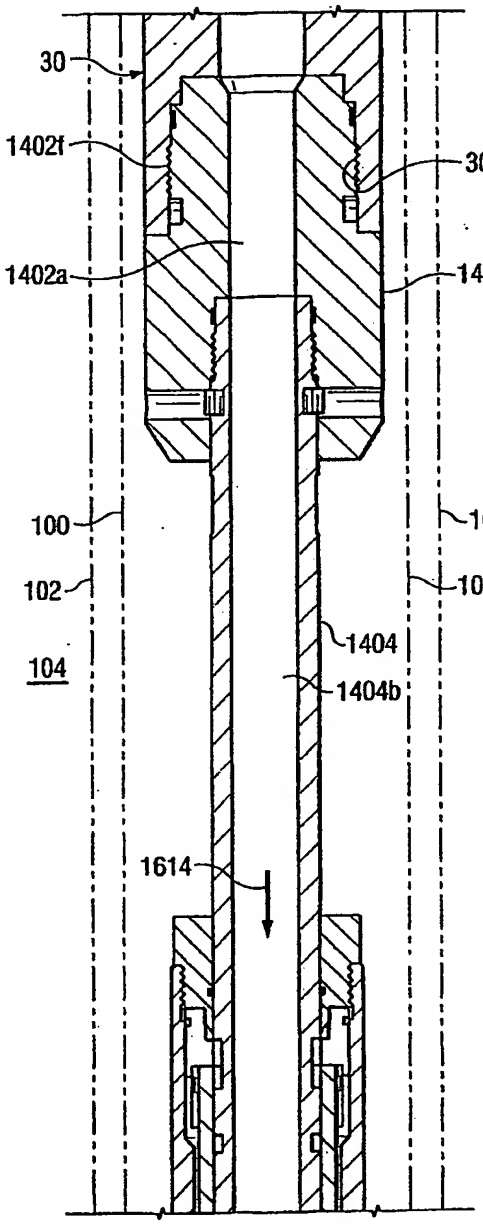

Fig. 16G1

25791.253

A4

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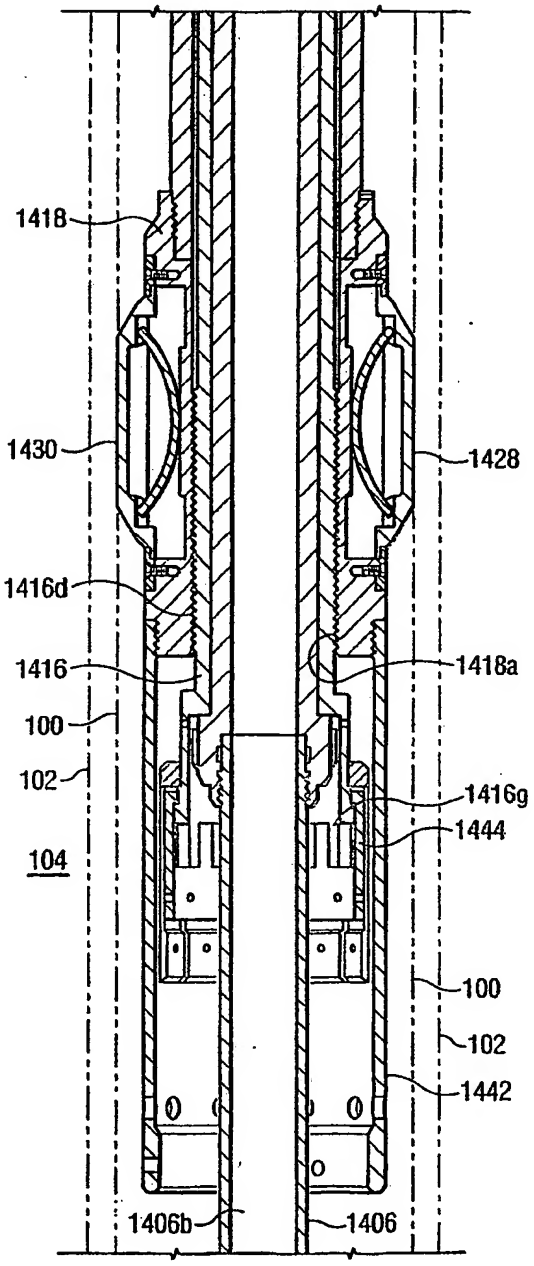

Fig. 16G2

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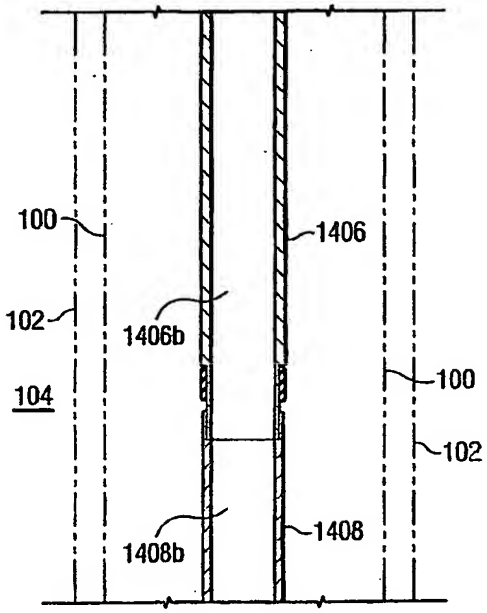

Fig. 16G3

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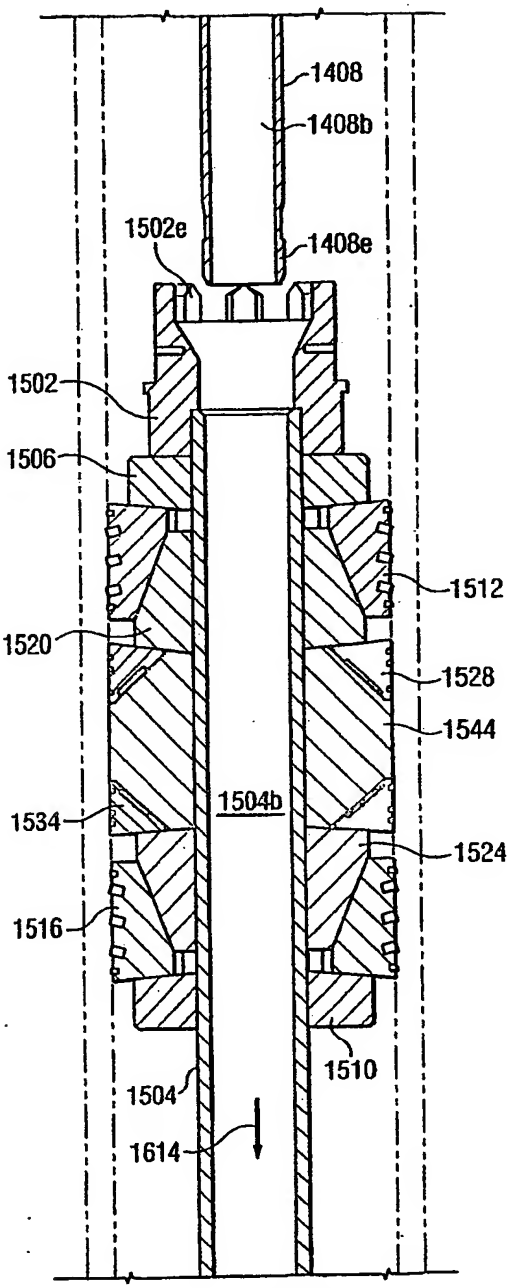

Fig. 16G4

25791.253

A4

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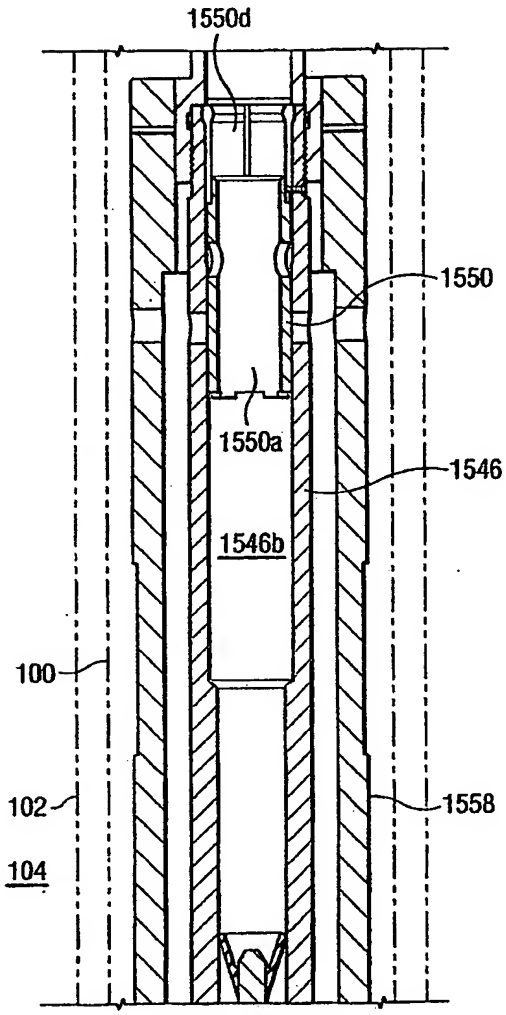

Fig. 16G5

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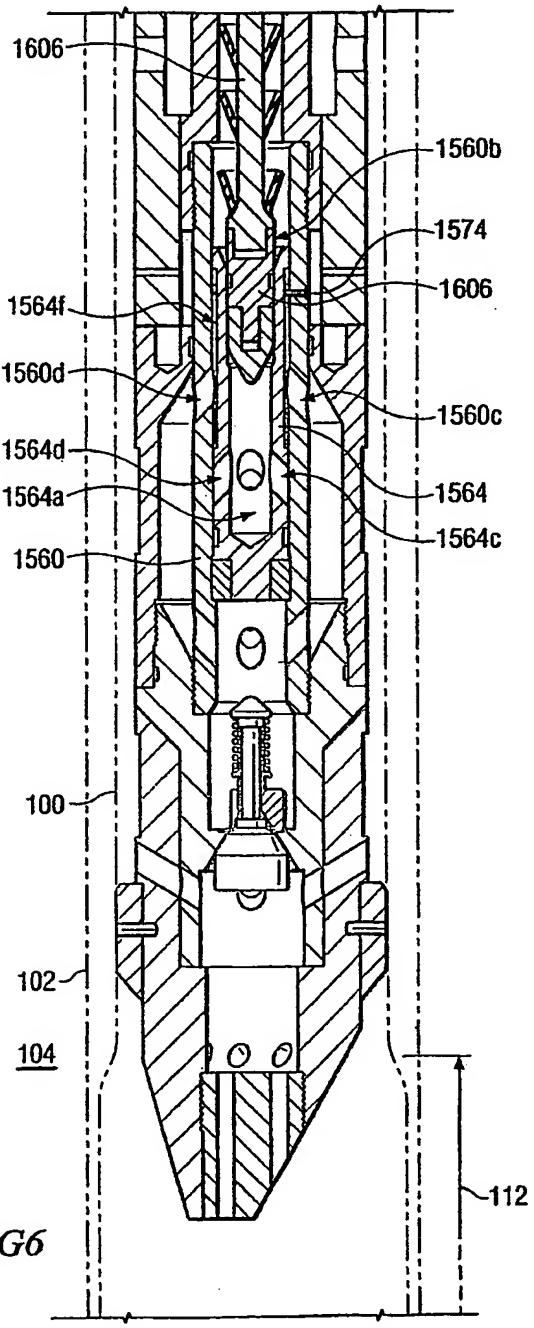

Fig. 16G6

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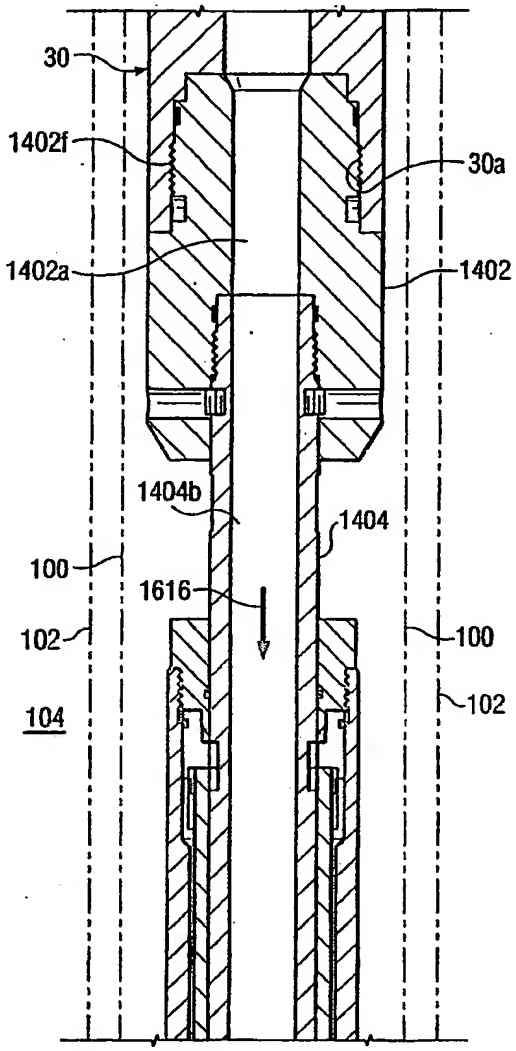

Fig. 16H1

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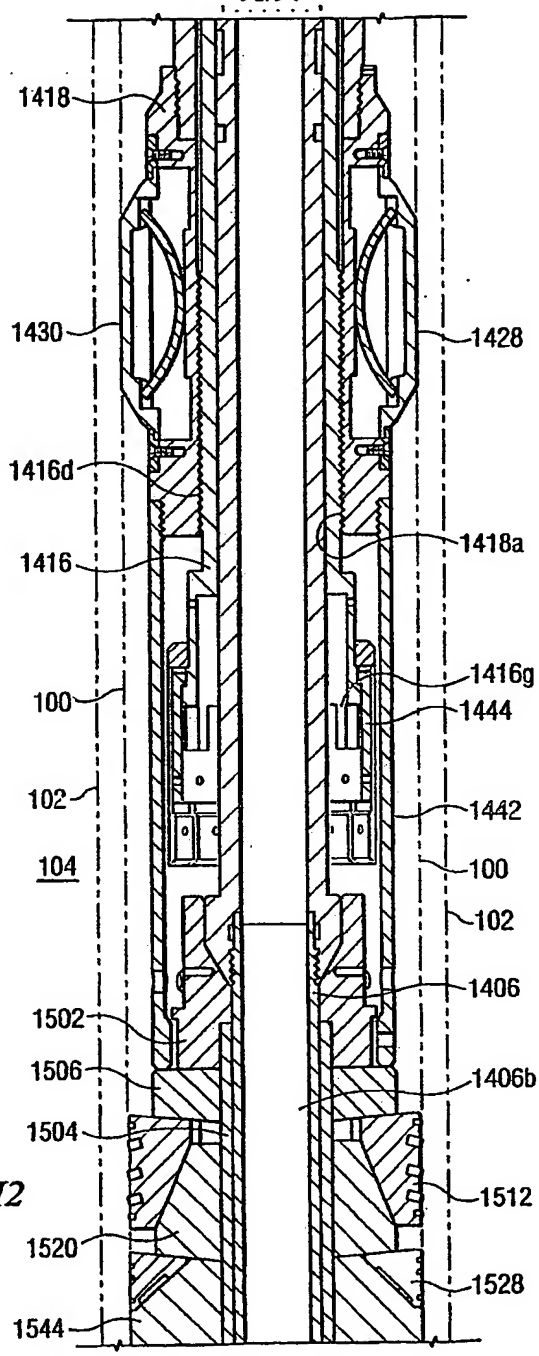

Fig. 16H2

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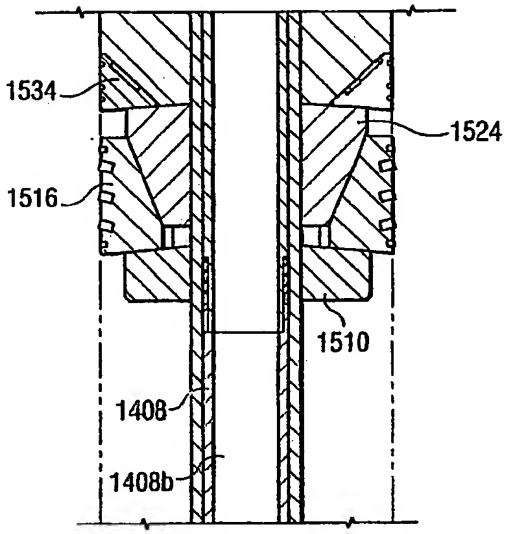

Fig. 16H3

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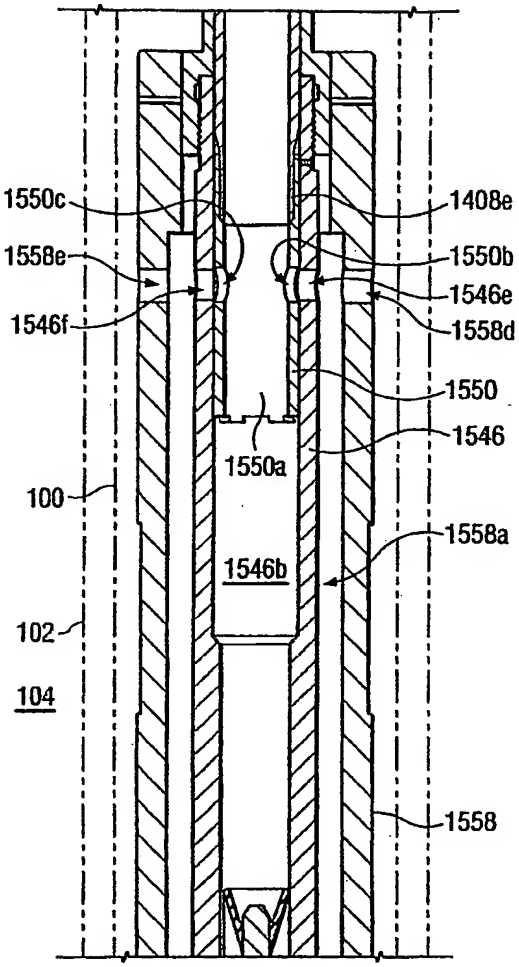

Fig. 16H4

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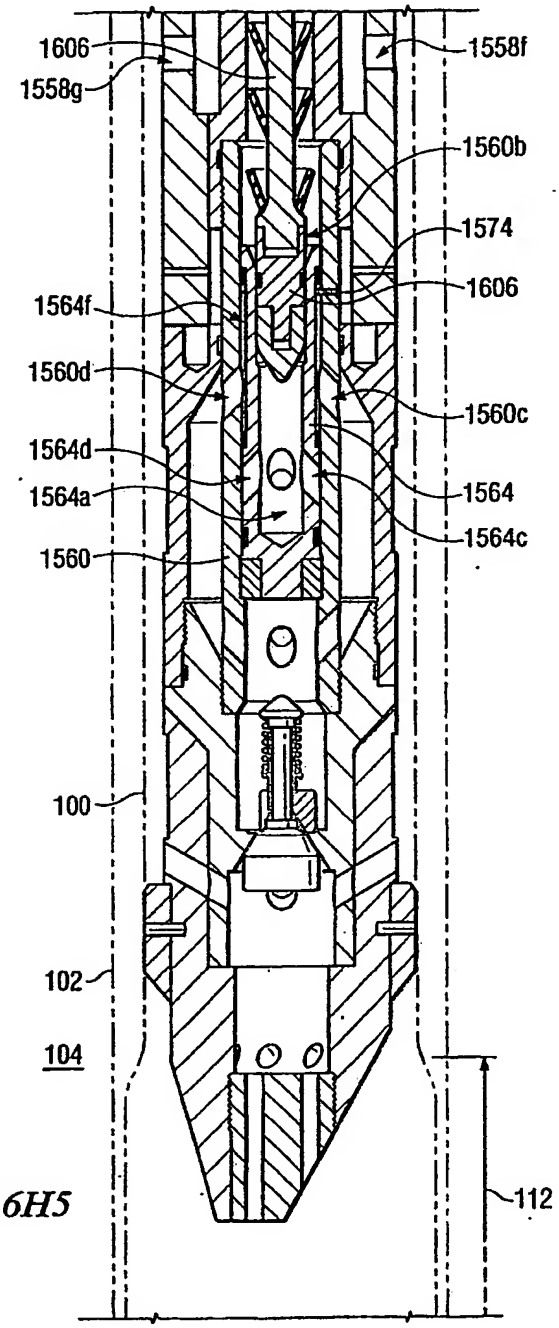

Fig. 16H5